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## CIVIL ENGINEERING.

### *Dr. Boucherie's Patent Process for Preserving Wood from Decay.**

[Extracted from the Report of the Jury of the French Exposition, and other Official documents.]

This patent is for an important improvement in the process of preparing timber, so as to preserve it from decay.

It is the invention of the eminent French chemist, Dr. Boucherie, who has devoted nearly twenty years in bringing it to perfection.

The system of Dr. Boucherie accomplishes two objects:—first, that of expelling the sap; and, secondly, filling the pores of the timber with a preservative solution.†

The manner in which this is effected is by applying the preserving fluid under pressure, so as to cause it to pass longitudinally along the fibres. The preserving fluid thus forces the sap out before it, and occupies its place.

The advantages which would result from expelling the sap, and replacing it with an antiseptic fluid, have been long known, and the idea of effecting it by applying the fluid under pressure at the end of a piece of timber is not new, having been suggested and patented many years ago by Mr. Bethel. But the means then used did not accomplish the object in such a manner as to admit of its commercial application.

Hence the more expensive process of creosoting has been adopted—where the timber is totally immersed in the oil under pressure—which does not permit the sap to escape.

Dr. Boucherie's process has been attended with complete success.

* From Herapath's Journal, No. 881, April 26, 1856.

† See Journal of the Franklin Institute, Third Series, Vol. II, p. 99; XI, pp. 142 and 314.

The apparatus employed, is of a very inexpensive character, and may be erected in a few days; it is capable of application on the most extended scale; and it is, in fact, very extensively employed at this time in preparing sleepers and telegraph posts for the French railways.

When the timber is under operation, the sap runs out from the ends in a clear stream, showing the amazing quantity of this fluid which is contained, and exhibiting the tubular structure of the wood, in the most striking manner; in fact, the preserving fluid will traverse a tree, twelve feet in length, with less pressure than is required to force it laterly through a plank three-quarters of an inch in thickness. When the sap is forced out the preservative fluid follows it, and its presence at the ends of the wood is ascertained by a chemical test.

Thus the sap and fermenting juices become completely expelled, and the timber becomes saturated throughout its length with the preserving fluid.

Important advantages arise in the employment of this process in this country. First, it may be applied successfully to Scotch fir, beech, elm, and other home-grown timber; secondly, it is not necessary that the wood should be dried or seasoned before being prepared, but, on the contrary, the operation is best effected within a few weeks after the tree has been cut down; thirdly, any cheap antiseptic fluids, such as solutions of sulphate of copper, or chloride of zinc, become perfect preservatives when applied in this manner; and, fourthly, no heat is required, and the wood is not rendered inflammable.

The result is a saving in first cost of about one shilling per sleeper as compared with Baltic timber creosoted; while the durability thus attained has been fully ascertained by the extensive trials already made in France, which will be further described.

*Success of the System in France.*—The first report upon this process was made in the year 1841, by a committee of the French Academy of Science, M. Arago being chairman, upon the occasion of a pamphlet on the subject by Dr. Boucherie being read before that distinguished body, and which was consequently ordered to be inserted in the "*Recueil des Savants Etrangers*," and copies to be forwarded to the Ministers of Agriculture, Commerce, Public Works, Marine, Finance, and War.

In the year 1850, the French government appointed a commission of distinguished engineers of the Ponts et Chaussées, and again in 1852, the principal officers of Genise, to minutely investigate and report upon the merits of this invention, and which they accordingly did; the reports on both occasions, being favorable to Dr. Boucherie's invention; while, at the close of the recent Exposition, the French government marked its sense of the public benefit derivable from it by awarding to its inventor, the rare distinction of the large gold medal of honor, of which there were only four conferred on the representatives of the whole of France.

*Duration of Sleepers prepared by this Process.*—In the year 1846, 80,000 sleepers thus prepared, were authorized to be laid down upon the Northern Railway of France, together with a certain quantity of unprepared sleepers.

In this instance, the Company chose wood that decays easily, and which, on that account, had been rejected for durable works. They employed beech, pine, alder, elm, and birch.

These sleepers were inspected every year, and each time were found in a perfect state of preservation. In May, 1855, Dr. Boucherie being desirous of exhibiting in the Exposition some wood prepared by this process, had a few of each kind of these sleepers taken up, and they were found in every instance to be in as perfect a state as when first laid down; the bark was unaltered, exhibiting two letters, the initial mark of the contractor, as clear and visible as when first impressed, while those sleepers which had been laid down unprepared had long since been reduced to decay. Upon these results being established, the greatest French Railway Companies, such as the Northern, Eastern, Nantes, &c., came forward, and required the immediate application of this process to the timber used upon their lines.

The following is an extract of a report upon the subject addressed to the jury of the late Exposition, by the administrators of the Northern Railway of France:—

"The sleepers prepared by Dr. Boucherie's process are preserved in an absolute manner, it being impossible to foresee a limit to their duration, seeing the present perfect state of preservation exhibited by those sleepers laid down eight years ago. The Northern Railway Company has adopted this process in preference to all others.

"Since the year 1853, the Northern Company has ordered more than 300,000 sleepers prepared by this system, and further orders would have been given, if they had found contractors disposed to deliver upon the same terms; however, at the present time tenders are required for more than 200,000 of those sleepers."—September, 1853.

*Telegraph Posts.*—The principle, as applied to the use of telegraphic posts, has been attended with equally favorable results, both as regards durability and economy. In the year 1846, the French Government substituted white pine posts prepared by this process, for the usual oak posts, for telegraphic wires on the Rouen line, and they are at the present time in as perfect a condition as when first erected.

This proves, and it is of importance to know, that timber thus prepared is equally efficacious when buried in dry or damp earth, and this is also exemplified daily by the telegraphic posts placed all over the French territory. Mr. Alexander, inspector of telegraphic lines in France, officially reported the costs of the two kinds of posts employed on that line as follows:—

| Prepared pine telegraph posts. Feet. | Unprepared oak telegraph posts. |
|---|---|
| Ordinary posts 5½ (4s. 5d.) | against 16fr. (12s. 9d.) |
| Winding posts 9 (7s. 3d.) | " 40fr. (£1 12s.) |
| Crossing posts 16 (12s. 0d.) | " 70fr. (£2 16s.) |

The following letter on the subject is from the administration of telegraphic lines in France:—

"*Paris, August* 14, 1855.

"Sir,—All the telegraph posts in the French empire have been prepared by your process.

"The administration had 200,000 on the 1st of January last, and since that time have caused 32,000 additional posts to be prepared.

"The preservation of the posts thus injected with sulphate of copper is rendered complete, although the first were prepared and laid down in the year 1846.

"It is with pleasure, doctor, that I am enabled to give you this information, in order that you may communicate it to the members of the jury of the Universal Exposition.

(Signed,) "H. DE VOUGY,
"Chief Administrator of Telegraphic Lines,
"Minister of the Interior."

"To Dr. BOUCHERIE."

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*The Resistance of Flexure: On the existence of an element of Strength in Beams subjected to Transverse Strain, arising from the Lateral Action of the fibres or particles on each other.** By WILLIAM HENRY BARLOW, F. R. S.

It has long been known, that under the existing theory of beams, which recognises only two elements of strength, namely, the resistances to direct compression and extension, the strength of a bar of cast iron subjected to transverse strain cannot be reconciled with the results obtained from experiments on direct tension, if the neutral axis is in the centre of the bar.

The experiments made both on the transverse and on the direct tensile strength of this material have been so numerous and so carefully conducted, as to admit of no doubt of their accuracy; and it results from them, either that the neutral axis must be at, or above, the top of the beam, or there must be some other cause for the strength exhibited by the beam when subjected to transverse strain.

In entering upon this question, it became necessary to establish clearly the position of the neutral axis, and the following experiments were commenced with that object; but they have led to others which are also described herein, and which establish the existence of a third, and a very important element of strength in beams.

I was desirous that the experiments for determining the position of the neutral axis should be made on such a scale and in such a manner as to place this question beyond doubt; and with this object the following means were adopted:—

Two beams were cast, 7 feet long, 6 inches deep, and two inches in thickness; on each of which were cast small vertical ribs at intervals of 12 inches: these ribs were one-fourth of an inch wide, and projected one-fourth of an inch from the beam. In each rib nine small holes were drilled to the depth of the surface of the beam, for the purpose of inserting pins attached to a delicate measuring instrument; the intention being to ascertain the position of the neutral axis by measuring the distance of the holes in the vertical ribs when the beam was placed under different strains. The measuring instrument consisted of a bar of box-wood, in which was firmly inserted, at one end, a piece of brass, carrying a steel pin; and at the other end a similar piece of brass carrying the socket of an adjusting screw. The adjusting screw moved a brass slide, which carried another pin similar to that inserted in the box-wood bar, at the

* From the Lond. Civ. Eng. and Arch. Jour., Jan., 1856.

other end of the instrument. The instrument was first made entirely of brass; but the effects of expansion from the heat of the hand were so sensible, that the wooden bar was substituted. The pins on the instrument fitted loosely into holes in the beam; and the mode of using the instrument was, to bring the pins up by means of the screw against the side of the holes with a certain degree of pressure, which, with a little practice in using the instrument, was attained with considerable accuracy.

Two beams were employed in order to avoid errors which might arise from accidental irregularities in the metal. The head of the adjusting screw was graduated to 100 divisions, and the screw had 43·9 threads to the inch, so that one division was equal to $\frac{1}{4390}$ of an inch.

The measurements were, in all cases, taken by the outsides of the pins of the measuring instrument; and when the instrument read zero, the actual distance of the outer sides of the two pins was $\frac{51661}{4390}$ inch, so that the constant number 51661 being added to the micrometer readings gives, in each case, the total distance in terms of $\frac{1}{4390}$ of an inch.

The measurements were taken four times in each position of the beam, and the error of measurement did not generally exceed from one to two divisions; but if in the four observations an error amounting to more than four was found, it was corrected by remeasurement.

The numbers given in the following tables are the micrometer readings, and the *means* of four observations in each case. In these experiments more than 3000 measurements were taken; but to avoid unnecessary figures, only the more prominent results are given.

Table No. I. contains the measurements of the centre division of the first beam under eight different conditions.

Table No. II. contains similar measurements of the second beam.

In the first experiment it was found that, when the beam was inverted, the measuring instrument appeared to bear upon a different part of the holes, so that a direct comparison between the distances, in the beam erect and inverted, cannot be made with the same accuracy as the comparisons of different strains upon the beam when in the same position. The first beam had been subjected to strain for the purpose of testing the measuring instrument previous to these experiments being made; but the second beam had not; and it will be seen that the effect of the strains in the latter case caused a permanent lengthening of the beam. The same strain was frequently applied afterwards, but I could not observe any increase of this effect. There was certainly a further apparent lengthening of both beams; but I ascertained that this arose from a slight wearing of the working parts of the measuring instrument, from the great number of measurements taken. In both experiments the beam was measured, first, in an erect position; and secondly, inverted; but in the tables, the measurements of the same parts of the beam are placed opposite each other, so that they may be compared throughout with greater facility.

Considering the very minute quantities which had to be measured, and the numerous causes of disturbance to which observations of so much delicacy were liable, such as changes of temperature or want of perfect uniformity in the dimensions or texture of the beams, the results, as shown by the column of differences, exhibit more regularity than could

have been expected ; and they point out the position of the neutral axis, as the centre of the beam, in a manner so decided, as to remove all further doubt upon this subject, not only in the smaller strains, but in the larger ones also ; which, in the case of the second beam, were carried to about three-fourths of the breaking weight.

It will be observed also, that the extensions and compressions increase in an arithmetical ratio from the centre to the extreme upper and lower sides of the beam.

These experiments having established the fact that the neutral axis is in the centre of a rectangular beam, and that its position is not sensibly altered by variations in the amount of strain applied, it becomes evident that if there were no other elements of strength than the resistance to direct extension and compression, the well-known formula

$$w = \frac{2\,a\,d\,f}{3\,l}$$

should give the breaking weight when $f$ is equal to the smaller of these two resistances, which in cast iron is the tensile resistance. But the weight so calculated is less than half the actual strength of the beam.

TABLE I.—*Measurements of the First Beam.*

| Beam erect. | | | | | Beam inverted. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. 1. | | No. 2 | | No. 3. | No. 4. | | No. 5. | | No. 6. | | No. 7. | | No 8. |
| At rest previous to being strained. | Difference. | Strained with 7573 lbs. on the end, equal to 14,746 lbs. on the centre. | Difference. | Weight taken off, condition the same as No. 1. | Beam reversed, bearing its own weight on the centre. | Difference. | Strain of 2893 lbs. on the end, equal to 5786 lbs. on the centre. | Difference. | Strain of 5133 lbs. on the end, equal to 10,066 lbs. on the centre. | Difference. | Strain of 7573 lbs. on the end, equal to 14,706 lbs. on the centre | Difference. | Weight taken off, condition the same as No. 4. |
| Micrometer readings. | | Micrometer readings. | | Micrometer readings. | Micrometer readings. | | Micrometer readings. | | Micrometer readings. | | Micrometer readings. | | Micrometer readings. |
| 2208 | +70 | 2278 | —67 | 2211 | 2210 | —33 | 2177 | —25 | 2152 | —26 | 2126 | +71 | 2197 |
| 2186 | +55 | 2241 | —53 | 2188 | 2187 | —25 | 2162 | —16 | 2146 | —21 | 2125 | +53 | 2178 |
| 2095 | +36 | 2131 | —33 | 2098 | 2103 | —20 | 2083 | —12 | 2071 | —13 | 2058 | +36 | 2094 |
| 2127 | +14 | 2141 | —13 | 2128 | 2129 | —10 | 2119 | — 8 | 2111 | — 5 | 2106 | +21 | 2127 |
| 2110 | — 5 | 2105 | + 5 | 2110 | 2117 | — 2 | 2115 | — 1 | 2114 | + 2 | 2116 | — | 2116 |
| 2052 | —21 | 2031 | +13 | 2054 | 2060 | + 5 | 2065 | + 6 | 2071 | +12 | 2083 | —20 | 2063 |
| 2095 | —39 | 2056 | +42 | 2098 | 2101 | +15 | 2116 | +14 | 2130 | +19 | 2149 | —37 | 2112 |
| 2052 | —58 | 1994 | +68 | 2052 | 2056 | +21 | 2077 | +21 | 2098 | +29 | 2127 | —60 | 2067 |
| 2101 | —73 | 2028 | +76 | 2104 | 2111 | +28 | 2139 | +26 | 2165 | +34 | 2199 | —73 | 2126 |

TABLE II.—*Measurements of the Second Beam.*

| Beam erect. | | | | | | | | Beam inverted. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. 1 | | No. 2. | | No. 3. | | No. 4. | | No. 5. | | No. 6. | | No. 7. |
| At rest previous to being strained. | Difference. | Strain of 8000 lbs. on centre. | Difference. | Strain of 16,000 lbs. on centre. | Difference. | Weight removed. | Difference. | Strain of 8000 lbs. on centre. | Difference. | Strain of 16,000 lbs. on centre. | Difference. | Weight removed. |
| Micrometer readings. | | Micrometer readings. | | Micrometer readings. | | Micrometer readings. | | Micrometer readings. | | Micrometer readings. | | Micrometer readings. |
| 1633 | +37 | 1670 | +65 | 1735 | −89 | 1646 | −44 | 1602 | −56 | 1546 | +97 | 1633 |
| 1525 | +28 | 1553 | +47 | 1600 | −63 | 1537 | −24 | 1513 | −46 | 1467 | +67 | 1534 |
| 1481 | +21 | 1502 | +34 | 1536 | −44 | 1492 | −19 | 1473 | −28 | 1445 | +42 | 1487 |
| 1442 | +11 | 1453 | +21 | 1474 | −23 | 1451 | −10 | 1441 | −12 | 1429 | +22 | 1451 |
| 1392 | + 2 | 1394 | + 7 | 1401 | − 1 | 1400 | + 1 | 1401 | —— | 1401 | + 4 | 1405 |
| 1375 | −10 | 1365 | − 9 | 1359 | +18 | 1374 | +17 | 1356 | +11 | 1402 | −17 | 1385 |
| 1338 | −18 | 1320 | −24 | 1296 | +44 | 1340 | +20 | 1360 | +27 | 1387 | −35 | 1352 |
| 1257 | −27 | 1230 | −37 | 1193 | +64 | 1257 | +31 | 1288 | +43 | 1331 | −57 | 1274 |
| 1248 | −42 | 1206 | −46 | 1160 | +85 | 1245 | +44 | 1289 | +57 | 1346 | −78 | 1268 |

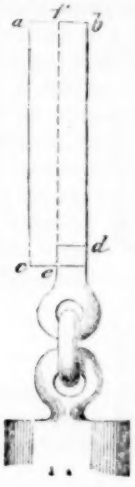
*Note.*—The extensions are marked +; the compressions are marked —.

In considering this question, I was forcibly struck by the circumstance, that, in applying the law of *ut tensio sic vis* to contiguous fibres, under different degrees of tension and compression, the effect of lateral adhesion is omitted, and each fibre is supposed to be capable of taking up the same degree of extension and compression from the same force as if it acted separately, and independently of the adjoining fibres. But it is well known as a practical fact, that there is a powerful lateral action which tends to modify the effect of unequal strains.

If, for example, a bar *a b c d*, have a strain applied at *e f d b*, the portion *d e f b*, will not be extended so much as it would be if separated from *a c e f*, unless an equal strain is applied to the portion *a c e f*. And if a portion of a bar cannot be extended in proportion to the force applied to it, unless the contiguous part is equally strained, it follows that the outer portions of a beam subjected to transverse strain will not be extended in proportion to the force applied, because the part nearer the neutral axis is not equally strained. The measurements made for obtaining the position of the neutral axis afford direct evidence on this point.

In the first beam, a strain of 5786 lbs. caused an extension of twenty-eight divisions of the micrometer; the points measured were $\frac{1}{1}\frac{1}{2}$ths of the depth of beam. The extension of the outer fibres was therefore $28 \times \frac{1}{1}\frac{2}{1} = 30$ divisions. The micrometer reading before the strain was applied was 2111, and the total distance of the points measured, was

$2111 + 51661 = 53772$. The effect of the strain caused therefore an extension of $\frac{30}{53772} = \frac{1}{1792 \cdot 4}$ of the length. The beam was 7 ft. 4 in. long, 6 inches deep, and 2 inches thick; and as




$$w = \frac{2\,a\,d\,f}{3\,l}$$

$$f = \frac{3\,l\,W}{2\,a\,d}$$

$$\text{or } f = \frac{3 \times 88 \times 5786}{2 \times 12 \times 6} = 10{,}608 \text{ lbs.}$$

so that, with a strain of 10,608 lbs. at the outer fibres, the extension produced was $\frac{1}{1792 \cdot 4}$ of the length.

But referring to the experiments made by Mr. Hodgkinson, it will be seen that a force of 10,538, applied by direct tensile strain, extends cast iron $\frac{1}{1056}$th of its length, being nearly double that exhibited by the beam. In the second beam, a weight of 8000 lbs. (from the mean of two results) produced an extension of forty divisions, which, at the extreme fibres, will be

$$40 \times \tfrac{2}{11}\text{ths} = 44 \text{ divisions.}$$

The mean reading of the micrometer, previous to the strain being applied, was 1439; therefore the extension was

$$\frac{44}{51661 + 1439} = \frac{1}{1207 \cdot}$$

The strain at the outer fibres produced by this weight was 14,666 lbs. so that 14,666 lbs. to the inch caused an extension of $\frac{1}{1207}$ th of the length.

But referring again to Hodgkinson's experiments on direct tensile strain, a weight of 14,793 lbs. produced an extension of $\frac{1}{645}$ths, of the length; which is again nearly double that produced by the same strain when excited by a weight applied transversely.

From these and other considerations I was led to think it probable that the effect of the lateral action of the fibres or particles of a beam, tending to modify the effect of the unequal strains and opposite forces, and thus diminishing the amount of extension and compression which would otherwise arise, constituted in effect a *resistance to flexure*; and it will be found that the following experiments fully confirm the existence of this resistance, as an additional element of strength in beams; and that it explains the apparent anomaly in the amount of tensile resistance when excited by direct, and by transverse strains.

Assuming the probability of a resistance acting independently of, or in addition to, the resistance of direct tension and compression, and varying with the flexure, it occurred to me that it might be exhibited experimentally by casting open girders, having the same sectional area in the upper and lower ribs; the same number of vertical ribs, but the distance between the horizontal ribs, and consequently the deflections of the girders different.

In these girders the neutral axis would necessarily be (like that of the

solid beam) in the centre, and the sectional area of the ribs, subjected to tension and compression being the same in each, the circumstances under which rupture would ensue would be similar, except in the amount of flexure.

The formula for the strength of a girder of this form is as follows :—

Let $a$ = the united area contained in the upper and lower ribs ;

$a'$ = the intervening space ;

$d$ = the total depth ;

$c$ = the distance between the upper and lower ribs ;

$l$ = the length of the bearing ;

w = the breaking weight ;

and F = the force required to produce rupture in the extreme fibres or particles.

Then $a + a'$ = the total area of the rectangle $m$, $n$, $o$, $p$,

$$\text{w} = \frac{2d\text{F}}{3l}(a'+a) - \frac{2oa'}{3l} \times \frac{c\,\text{F}}{d};$$

or

$$\text{w} = \frac{2\text{F}}{3l}\left\{(a'+a)\,d - \frac{a'c^2}{d}\right\},$$

$$\text{w} = \frac{2\,\text{F}a}{3l}\left(d + c + \frac{c^2}{d}\right).$$

The formula may also be obtained by calculating the moments in the usual way. Using the same letters as before, we have, for the distance of the centres of compression and extension,

$$\frac{2}{3}\left(d + \frac{c^2}{d+c}\right).$$

The force acting when F is the strain which breaks the outer fibre will be

$$\frac{\text{F} + \frac{\text{F}\,c}{d}}{2} = \text{F}\frac{\left(1 + \frac{c}{d}\right)}{2}.$$

Hence

$$\frac{\text{w}}{2} \times \frac{l}{2} = \frac{2}{3}\left(d + \frac{c^2}{d+c}\right)\left(\frac{1 + \frac{c}{d}}{2}\right)\frac{a\,\text{F}}{2};$$

or

$$\text{w} = \frac{2\,\text{F}a}{3l}\left(d + c + \frac{c^2}{d}\right).$$

The value of w being obtained by experiment in each case, we have from the formula

$$\text{F} = \frac{3l\text{w}}{2a\left(d + c + \frac{c^2}{d}\right)}$$

and if the strength depended only on the direct tensile power of the material, F should in each case be constant, and equal to the direct tensile resistance; but if, in addition to this, there existed another element of strength in the resistance occasioned by the lateral adhesion and varying with the flexure, the value of F would be found, in every case, greater than the tensile resistance, and to increase when the flexure increased.

Four beams were cast of each form, of which the details, the exact

dimensions, deflections, and breaking weights are given in the Appendix. The results were as follows, obtained from the mean of four experiments on each form of girder:—

| Description of beam. | Total depth of beam. | Sectional area of the two ribs. | Distance between the ribs. | Deflection with nine-tenths of breaking weight. | Breaking weight. |
|---|---|---|---|---|---|
| | inches. | inches. | inches. | inches. | lbs. |
| Form No. 2 | 2·51 | 1·98 | ·54 | ·510 | 2468 |
| " 3 | 3·00 | 2·20 | 1·00 | ·401 | 3119 |
| " 4 | 4·00 | 1·98 | 2·03 | ·301 | 4339 |

The value of F being derived from each of these results by the formula

$$F = \frac{3lw}{2a\left(d + c + \frac{c^2}{d}\right)}$$

| | Deflection. | Value of F. |
|---|---|---|
| Form No. 2 | ·510 | 35,386 |
| Form No. 3 | ·401 | 31,977 |
| Form No. 4 | ·301 | 28,032 |

The tensile strength of the metal obtained from the mean of eight experiments, given in the Appendix, was 18,750 lbs; here, therefore, was decided evidence, first, that the value of F, exceeded the tensile strength in all three forms, and that it increased with the increase of flexure.

In connexion with the above described experiments, I made four others on solid beams having the same sectional area and length as the open girders; and the mean of the four gave a breaking weight of 1888 lbs. Obtaining the value of F, from these experiments, we have,—

| Deflection with nine-tenths of breaking weight. | Value of F. |
|---|---|
| ·670 | 41,709 lbs. |

which again exhibits an increase in the value of F, with an increase in the deflection.

(To be Continued.)

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## *On Steep Gradients of Railways, and the Locomotives employed.**

By CHARLES R. DRYSDALE, Assoc. Inst. C. E.

Read before the Institution of Civil Engineers, April 8th, 1856.

The object of the paper, was to compare the results of some of the performances of locomotives of various construction, and of stationary steam engines working ropes, and also the atmospheric system; to examine these results, and from them to determine the most economical and best manner of effecting the passage of mountain chains by railway lines.

A history of the construction of the Semmering and Giovi passes was first given, with the nature of the curves, gradients, &c. The locomotives of the Semmering and Giovi were then described. Some English steep inclines were then referred to, and the duties of the Semmering

* From the Lond. Civ. Eng. and Arch. Journ., May, 1856.

and Giovi engines were compared with the English engines for evaporating power, for horse-power per cubic foot of water evaporated, and for weight drawn in proportion to the weight of locomotive.

After this the duty of the stationary engine on the Edinburgh and Glasgow line was analyzed, and the atmospheric incline on the St. Germain's railway.

*The Semmering Railway.*—A description was given of some of the most remarkable viaducts and tunnels of the line.

1. The viaduct of Kalte Rinne, which was composed of two stages, with a gradient of 1 in 80, and a radius 10 chains 600 feet long, with an extreme height of 150 feet.

2. The Wagner Graben viaduct had a gradient of 1 in 47; its length was 470 feet, and the greatest height was 127 feet.

3. The Semmering tunnel was 72 chains long; its greatest depth was 374 feet, lined with masonry. The length from Payerbach to Murzzuschleg was 21·52 miles, thus composed:—

| | Miles. | Gradient. |
|---|---|---|
| Payerbach to Eichberg, | 3·84 | of 1·46 |
| Eichberg to Klamm, | 2·53 | " 1·40 |
| Klamm to Breitenstein, | 3·26 | " 1·47 |
| Breitenstein to Semmering, | 3.58 | " 1·54 |
| Semmering to Spital, | 4·44 | " 1·50 |
| Spital to Murzzuschleg, | 3·84 | " 1·50 |

The average gradient of Payerbach to the summit was 1·47 for 13·21 miles. The curvature was very great from Payerbach to Klamm; about 700 feet radius. The rails used weighed 88 lbs. to the yard. The engines employed had 75 square feet of fire-box surface; 189 tubes 2 inches diameter and 15 ft. 7 in. long = 1585 square feet heating surface, and 12·6 square feet of grate surface.

The weight of the engine filled and loaded, was 55¼ tons—13½ tons on the leading wheels, 12¼ tons on the middle, and 13 tons on the driving wheels. Toothed wheels were afterwards added, and thus all the weight was brought to bear for adhesion. The diameter of the cylinders was 18·7 inches, the stroke 25 inches, and the diameter of wheels 3 ft. 7¾ in. Before the toothed wheels were added to connect the tender to the locomotive, the duty of the engine required by government, was to draw 110 tons up 1 in 40, at ten miles an hour, consuming less than 144 cubic feet of dry wood per hour; to perform this, the load on the driving wheels must be at least eight times the tractive force available. Or 8 × 11,040 = 88,320 lbs., nearly 40 tons on the driving wheels was required. The resistance of 11,040 lbs. was calculated from the gradient 1 in 40, giving 56 lbs. per ton, due to the gravity, and the remaining 13 lbs. was due to speed and traction on the level.

The performance of the engine before adding the toothed wheels was, on a gradient 1 in 40, dead weight = 110 tons, engine and tender = 55¼ tons. The water evaporated per hour (stoppages not included)=255 cubic feet. The wood consumed to evaporate this = 3820 lbs. The speed =11·4 miles per hour.

1°. This gave 4·15 lbs. of water evaporated per hour, by each pound of wood, or 9·6 lbs. water evaporated per square foot of heating surface.

2°. As to the horse power usually represented by the evaporation of

1 cubic foot of water per hour, 165 tons (engine and tender included) at 11·4 miles per hour, drawn up 1 in 40, gave 347 h. p., and 255 cubic feet of water evaporated ;—consequently ·73 cubic foot evaporated was equivalent to one horse-power.

The "Mammoth," Great Western Railway, = 0·76 cubic foot per h. p. per hour.

The Goods Engine, No. 227, North-Western Railway, = ·675 cubic foot per h. p. per hour.

3°. The proportion that the dead weight bore to the weight of the engine and tender, gave the following results :—

The Semmering engine, = 4·2 h. p. per ton of engine and tender.

The "Mammoth" = 3.2 h. p. per ton of engine and tender.

The North-Western No. 227, = 3·55 h. p. per ton of engine and tender.

These experiments were brought forward to show, that no engine in England would alone work the Semmering traffic. When the hinder wheels were connected with the others in the Semmering locomotive, the performance rose to 220 tons up 1 in 40, at 9½ miles per hour, giving with the engine and tender included a duty of 380 horse-power ; and 165 tons dead weight carried up by 55¼ tons of engine gave $\frac{285}{55{\cdot}25} = 5{\cdot}2$ h. p. exerted per ton of engine and tender.

The mean pressure of steam was 80 lbs.

Lastly the economical effect stood thus:—44 lbs. of water were evaporated, and 11 lbs. wood were consumed per h. p. per hour including the engine and tender. Without these:—14·6 lbs. of wood were consumed per horse-power per hour, giving 14·6 lbs. to raise 33,000 × 60 lbs., or 1 lb. of wood to raise 13,600 lbs. a foot high; or again, 82,208 lbs. irrespective of speed.

*The Giovi Incline.*—On the Giovi incline passing the Appenines, near Genoa, on the Turin and Genoa Railway, the engineer who introduced the working of this line by locomotives, had to contend against a strong party who were in favor of stationary engines.

The Giovi incline commenced at 7¾ miles from Genoa, 295 feet over the sea, and ascended for 6 miles to an elevation of 1184 feet. Average gradient 1 in 36 ; the length of tunnel = 2·55 miles ; the depth of shaft = 600 feet ; the cost per yard = £118.

Two engines of the same size (built by Messrs. R. Stephenson & Co.) coupled together and managed by one driver, were used to work the incline. Each carried its own coke and water. The diameter of wheels = 3 feet 6 inches. The cylinders = 14 inches, with a stroke = 22 inches. The locomotives were bolted together with the fire-boxes facing each other, and the driver stood on a common platform. Filled and loaded the two engines weighed 50 tons.

In fine weather the locomotives took up about 100 tons of load, and in the worst weather never less than 70 tons, at a speed of 15 miles per hour. The consumption of coke per ton per mile, amounted to, not including engine, 1·94 lbs.; including engine 1·16 lbs. The consumption of coke to draw the engine from the bottom to the top, 6 miles, of 1 in 36, was 8·27 cwt.

1°. The water evaporated per pound of coke, was 8·5 lbs.

2°. 150 tons drawn up 1 in 36, at 15 miles per hour, gave a result, with the engine of 444 horse-power; and without the engine 295 horse-power.

3°. This gave 5·9 tons raised per ton of engine.

4°. 9·7 lbs. coke raised 1,980,000 lbs.
Or 1 lb. coke, 204,000 lbs. 1 foot high.
Or, irrespective of speed, 169,600 lbs.

The *Accrington Incline* was 1 in 41·6 for two miles. 71·6 tons were raised at 6·31 miles per hour up the incline. The engine had cylinders 18 inches diameter, 24 inches stroke, 6 coupled wheels of 5 feet diameter.

The weight of the engine = 26·25 tons; tender = 16·75 tons;—total = 43·00 tons. The work done = 74 horse power, which gave 1·7 horse power raised per ton of the engine and tender.

The *Lickey Incline* had a gradient of 1 in 37, worked by goods engines with cylinders 16 inches diameter, and 24 inches stroke, and driving-wheels 5 feet diameter, and weighed 32 tons, with an assisting engine whose cylinders = 16 inches, and stroke of 24 inches, and driving-wheels of 4 feet diameter, weighing 35 tons; together = 67 tons. The results were that 240 tons were drawn up 1 in 37, at a speed of 6½ miles per hour, giving 293 horse power, or 4·4 horse power exerted per ton of motor.

The *Edinburgh and Glasgow Incline.*—This incline was stated to be 1¼ mile long, with a gradient of 1 in 42. During a trial of twenty-three months, the miles run lifting trains were 21,250½, and the number of ascents = 14,167.

The number of carriages drawn up = 205,181.

The average gross weight per train = 86 tons.

The prime cost of the rope = £1094.

The coal consumed per mile to lift this weight of 86 tons = 527 lbs.

Cost of coal per mile = 11·195*d.*

The friction of the rope = $\frac{1}{20}$ of its weight.

The cost of working the line, including the rope, = 50·299*d.*

The performance was 86 tons drawn up 1 in 42, at 30 miles per hour, giving 452 h. p. To this was to be added 211 h. p. to move the rope; and 35 lbs. of coal were expended per horse power.

Secondly, without consideration of speed, 1 lb. of coal raised 45,700 lbs. 1 foot high.

The incline was worked by a wire rope of 4⅜ inches, and on several occasions there had been 30 loaded carriages on each train, and goods trains of 120 tons, carried up without detention.

The total cost of working the incline for one year was £734 18*s.* against £3204 16*s.* for locomotives, giving a difference in favor of the stationary engine of £2460 18*s.* 9*d.*

The engines used on the line were probably not well adapted for the traffic, and indeed, for such short inclines, the benefit of the stationary engines was very doubtful; there seemed, however, to be some propriety in using them for the passage of long Alpine gradients, as a rope could be made to work a length of 6 miles, and thus steeper gradients might be adopted—even 1 in 25, avoiding thereby great expense in constructing viaducts, &c.

*St. Germain's Atmospheric Railway.*—The gradient at the St. Germain's incline was 1 in 33 for the distance of fifty chains, and the total length of the inclination was 1·46 miles with an average gradient of 1 in 43.

From June 2d, to August 18th, 1855, the number of ascents = 1413; the weight of carriages lifted = 73,241 tons. The total cost of working, including tallow, engine-men, coal, water, &c., = £612 10*s*. The cost per mile of ascent, = 5*s*. 9½*d*. The average weight raised per train = 51·8 tons. The cost of coal = 20*s*. per ton. Economically, leaving speed out of consideration, 1 lb. of coal raised 31,136 lbs. 1 foot high.

The following summary of results was given:—

Semmering Locomotives.—Total h. p. exerted = 380 h. p.; to lift the train = 285 tons; h. p. per ton of motor = 5·2 tons. Economically (irrespective of speed), one lb. of wood raised 82,208 lbs. 1 foot high.

Giovi Locomotives.—Total h. p. exerted = 444 h. p. per ton of motor = 5·9 h. p. economically (irrespective of speed), 1 lb. of coke raised 169,600 lbs. 1 foot high.

Glasgow Stationary Engine.—Total h. p. to raise the train = 452 h. p. without the h. p. to lift the rope, economically, one lb. of slack raised 45,700 lbs. one feet high, irrespective of speed.

St. Germain's Atmospheric System.—One lb. of coal raised 22,063 lbs. one foot high, irrespective of speed.

These results, as compared with the alleged duty of the Cornish boiler, one million pounds, one foot high, were still far below laboratory duties.

*April* 15.—The discussion being renewed on Mr. Drysdale's Paper, was continued throughout the evening. It was stated that on the Oldham incline, 1½ mile in length, with a gradient of 1 in 27, a tank engine weighing about 27 tons, drew at the rate of 15 miles per hour, a train of nine loaded carriages weighing 50 tons. The dimensions of the engine were—leading wheels, 3 ft. 6 in. diameter; driving wheel (four coupled), 5 feet diameter; cylinders, 1 ft. 3 in. diameter; length of stroke, 2 feet.

It was argued that it was extremely difficult, to establish any useful comparison between the working of various inclines, in consequence of the dissimilarity of conditions, of local circumstances, and of the different modes of keeping account of the expenses. That instead of affixing the limit of adhesion, as on the Semmering, at eight times the weight on the wheels, as compared with the force of the pull of the engine, it would be practicable to ascend much greater inclines with only five times the weight to the drag of the engine. That the Semmering engines could not be received as any improvement upon the construction of the engines employed ten years ago at the Lickey incline, where two small engines had been in the habit of drawing, up a gradient of 1 in 37, trains of 50 loaded wagons, weighing at least 250 tons, at a speed of 6½ miles per hour; therefore that one of these comparatively small light engines, would be quite able to haul 165 tons over the Semmering incline, at a speed of 11 miles per hour.

Though it could not be denied that English railway engineers were formerly prejudiced against any steeper incline than 1 in 100, and had believed that gradients of 1 in 50 could only be worked by means of

ropes, yet it must be remembered that fifteen years ago, Halifax was approached by a gradient of 1 in 44, and that twenty-two passenger trains per day, besides goods trains, were, without difficulty, conveyed over that incline by locomotives. There was, therefore, nothing new in these steep inclines, nor in the manner of working them. It should also be mentioned, that the result of the later experience went to prove, that it was more advantageous to rely on the locomotive than on any system of ropes. Not only had the latter system been abandoned on the Euston incline (London), and at Miles Platting incline (Manchester), but even at Oldham, where there was a gradient of 1 in 27 for $1\frac{3}{4}$ miles, the rope was taken away two years ago, and the traffic was now entirely dependent on locomotives.

It was urged, that as early as 1839-40 the Lickey incline had been freely ascended by locomotives conveying trains, without any brake in the course; the conditions of the Lickey and of the Dainton inclines, situated on the course of the lines, were very different from those of terminal inclines, such as the Oldham, Halifax, Manchester, &c.

The sharp curves, of not more than 10 chains radius, on the Semmering, must be taken into consideration, as on a gradient of 1 in 42, they would materially influence the working of the engines, at even a moderate speed. The question was, whether it was necessary to have such heavy engines as those of the Engerth construction, or whether it was not more convenient and economical to work inclines by means of two coupled engines, as at the Giovi incline. The latter opinion was strongly contended for, as also that generally the inclines in England were worked better, cheaper, and more regularly than that of the Semmering. In the year 1833, locomotive engines frequently ascended the St. Helen's incline of 1 in 30, although the traffic was worked by means of ropes.

Particulars were given of some experiments made with an engine intended for the Santander and Alar railway, in Spain; from which it appeared that upon an inclined plane, at Sheffield, about 300 yards in length, and rising 1 in 27, the engine drew up $23\frac{1}{2}$ tons, (exclusive of the tender,) at a velocity of about $2\frac{1}{2}$ miles per hour. The same engine, when tried on the Lickey incline, on a foggy day, with drizzling rain falling, took up in the first experiment a load of nearly 46 tons in six wagons at an average rate of about 10 miles per hour, and in the second experiment $29\frac{1}{4}$ tons, in four wagons, at a mean velocity of $18\frac{1}{2}$ miles per hour.

It was again insisted, that circumstances varied so much as to render comparison of working the inclines almost impossible. It was necessary either to have special experiments under special circumstances, or to have such a large number of experiments as to arrive at the truth, by taking the average of the results. It was evident that the load that could be hauled by an engine, was in proportion to the weight that could be put upon the driving-wheels; but that was limited by circumstances.

In order to arrive at some idea of the relative advantage of employing one very powerful, or two less powerful engines, two engines of equal power were taken, their speed and pressure compared, and a similar load of 280 tons, was placed behind each. It was thus found that the two engines, when coupled together, took both loads up the same incline in the same time that each had taken up the half load separately.

At Edge-Hill, Liverpool, there were three inclines, of 1 in 48, 1 in 90, and 1 in 56, respectively. These were still worked by ropes, and stationary engines, because, being situated in tunnels, it was found that the condensation of the steam on the rails when locomotives were tried, so lessened the adhesion, that in these particular cases it almost amounted to an impossibility of carrying out that system.

The important point to consider was the amount of adhesion to be obtained: one-eighth the weight was contended to be a fair average, as under certain circumstances of weather, &c., it fell to one-tenth, or one-fifteenth. That point being determined, the rest was a question of the advantageous employment of steam and the construction of the engines themselves.

It was stated that the Paper should be received as a record of facts, brought by the author under the notice of the Institution, rather than with a view to establishing any particular ideas as to modes of working inclines.

It must be evident that the system of working the Giovi incline by two of Messrs. R. Stephenson & Co's. coupled engines was decidely better and more economical, than the system of using such enormously heavy engines, as those constructed from the Engerth design for working the Semmering incline. It was decidedly more economical, as well as more convenient, to be able to work an incline by merely coupling together the ordinary engines of the line, than to have engines constructed expressly for the duty of ascending steep gradients, and unfit for the other portions of the line. Besides, the injury to the permanent way by such enormously heavy engines must be considered, when comparing their duty with that of two engines, whose weight was so much better distributed.

Circumstances of climate would always affect adhesion;—in the fine dry cold climate of Norway, inclines could be advantageously worked; whereas in London fog, or even with the ordinary moisture of a dewey night, the adhesion would be materially impaired.

Ropes had been generally superseded by locomotives, but it should not be rashly decided to abandon them entirely, as there were situations were steep terminal gradients might still be advantageously worked by them; whereas it would be preferable, or even almost indispensable, to work the inclines in the course of a line by locomotive power. The difference between current and terminal inclines must always be considered. The facts observed and collected by the author would be found valuable as data, from whence every engineer would draw his own conclusions, and apply them so as to meet the peculiarity of his own case.

In conclusion it was urged that, with regard to adhesion, no *a priori* arguments should be relied on, but facts alone should be had recourse to, and these, it was asserted, would be found to give the power of adhesion as being from one-eighth to one-tenth of the weight on the wheels. It was thought to be of great importance that the question of the comparative economy of working inclines by locomotives or by ropes, should be clearly investigated. In hilly districts, if gradients of 1 in 20 could be worked with facility, the construction of many costly viaducts and other structures might be avoided; and, of course, the less the expense necessary to be incurred in the formation of any railway the greater chance was there of its being satisfactorily executed.

# AMERICAN PATENTS.

*List of American Patents which issued from April 29th, to May 27th, 1856, (inclusive,) with Exemplifications.*

APRIL 29.

202. For an *Improved Sawing Machine;* Thomas J. Alexander, Westerville, Ohio.

*Claim.*—"1st, Giving to the revolving saw a reciprocating action across or along the bed, in combination with the reciprocating movement of the bed or table, simultaneously in opposite directions. 2d, Hanging or supporting the revolving saw and bed or table, to give them their specified compound parallel, or otherwise equivalent reciprocating movement, simultaneously in opposite directions, or to radial arms geared together by toothed segments, or otherwise equivalently connected or driven, to produce the necessary contra joint action of said radial arms, whereby the proper reciprocating actions of the saw and bed relatively to each other, are ensured, and the movement of the one may be made to actuate the other."

203. For an *Improvement in Chain Cable Hooks;* Enoch Applegate, Wilmington, Delaware.

*Claim.*—"The hinged arms, and projections for supporting the anchor, in combination with the lock lever and projections."

204. For an *Improvement in Electro-Magnetic Telegraphs;* Henry N. Baker, Union, New York.

*Claim.*—"The arrangement of the type wheel, the escapement wheel attached thereto, the arrangement of the clutch or detent acting upon the said escapement wheel, relatively to the armature of the type wheel magnet, and the arrangement of the whole relatively to the tongue, by which the types are lifted up into contact with the paper, in such a manner, that when the circuit is closed through the type wheel magnet, the tongue will be opposite a space between two letters, and when during the closing of said circuit—the circuit by which the said tongue and the feed rollers are acted upon is closed, the tongue will be inoperative and the feed rollers allowed to act, without any impression being given, thereby producing a space between the printed letters or words."

205. For an *Improved Pen and Pencil Case;* Edward Baptis, Hoboken, New Jersey.

*Claim.*—"The two spiral grooved tubes, when arranged so that the pen holder and pencil slide will be shoved alternately in and out by the case, and moved simultaneously in opposite directions."

206. For an *Improvement in Cradling Harvesters;* Milton Barlow, Lexington, Kentucky.

*Claim.*—"Constructing and operating the cutting portion of the machine, so that by the use of the eccentric, or a cam or crank as substitute therefor, operating on the cradle, when in combination with means of delivering the cut grain by the use of a rake."

207. For an *Improved Machine for Excavating and Moving Earth;* Asa W. Cady, Sullivan, New York.

*Claim.*—"The plan embodied in the structure of the bridge and scraper contained in their form, and method of use in the machine, and in the arrangement made for operating and controlling these with the gearing and fixtures, as actuated by hand or horse-power, and in adapting them to and combining them with a wheeled vehicle or wagon, so the operation of excavating earth may be performed."

208. For an *Improvement in Cigar Machines;* William Dorson, Huntington, Conn.

*Claim.*—"The combination of the forming rollers, the flexible apron and the spring dies."

209. For an *Improvement in Scaffolding;* John M. Dearborn, Boston, Mass.

*Claim.*—"This improvement in the construction of movable scaffolds, which consists, first, in constructing the upright standards of two planks or boards, leaving a space between them, in which spaces the ledgers can be moved up or down, and secured in any desired positions. Also, constructing the upright standards with tenons on the top, which fit into the bottom space, strengthened by an iron sleeve between the planks of the upright standards of the next upper section, whereby I am enabled to extend the staging vertically."

210. For an *Improvement in Joint Bodied Buggies;* Edwin J. Green and Moses H. Wheeler, Cedarville, New York.

*Claim.*—"Supporting the front or seat section of a joint body carriage on a spring reach, by means of a bolt or equivalent support, whereby we avoid the use of a spring, as heretofore used under the seat, but still have the advantages of said spring, by using the spring reach as such."

211. For an *Improved Shingle Machine;* John B. Evins, Greencastle, Indiana.

*Claim.*—"1st, The combination of the knife frame and panel frame, when constructed, arranged, and operating conjointly. 2d, Operating the knife and panel frames, by means of the lever, when connected to the two levers, so that two movable fulcrums are obtained, the pitman being attached to the lever between the fulcrums."

212. For an *Improvement in Hand Seed Planters;* Edward Hopkins, Cincinnati, O.

*Claim.*—"The arrangement of the rod and spring, combined with the catch block and sliding plate, for operating the semi-circular cylinder and lid."

213. For an *Improvement in Attaching Harvester Cutter Blades to the Sickle Bar;* W. H. Hovey, Springfield, Mass.

*Claim.*—"Attaching the teeth to the sickle bar, by means of the grooved pins and bar, attached to the bar, and the plate having holes and slots made through it."

214. For an *Improvement in Automatic Rake for Harvesters;* Salem T. Lamb, New Washington, Indiana.

*Claim.*—"Giving the rake its circular motions, by means of the traversing and rocking cam, in combination with the revolving cam, which gives the longitudinal motion, through the intervention of the devices."

215. For an *Improvement in the Construction of Dry Gas Metres;* William Lyon and Charles W. Dickinson, Newark, New Jersey.

*Claim.*—"1st, So constructing the metallic bellows for the measurement of gas, that the spring or bend of the metal may form chambers of varying dimensions and of definite capacities for receiving and measuring the gas. 2d, Giving motion to the registering wheel by the impinging lever operated by the wheel, and the levers and connexions communicating with the bellows."

216. For an *Improvement in Corn Shellers;* Ebenezer Mathers, Morgantown, Va.

*Claim.*—"The construction of the shaft with channels—said channels being furnished with elastic tongues."

217. For an *Improved Machine for Printing Woolen and other Fabrics;* John M'Innes, Braintree, Mass.

*Claim.*—"The general construction and arrangement of the machine: that is to say, the vertical cylinder with its series of blocks, in combination with a corresponding series of sieves."

218. For an *Improvement in Door Fasteners;* Elisha P. Moulton, Baltimore, Md.

*Claim.*—"Constructing turn buttons, or fasteners, the stem and head of the button being in one piece, and having a collar at its end that prevents the button from being withdrawn from its frame, by the strain brought on the head of the button by the door which it secures—the stem of the button having a square part that is pressed against by a spring."

219. For an *Improvement in Corn Planters;* Silas G. Randall, Rockford, Illinois.

*Claim.*—"The combining with the seed tube, a cut-off valve, for closing or opening said tube, as the case may be; said valve moving edgewise against the soil when the passage is opened to allow the grains to pass into the ground, and operated from a lever."

220. For an *Improvement in Harvester Cutters;* Benjamin T. Roney, Philadelphia, Pennsylvania.

*Claim.*—"Slotted bar and cutter bar, as connected together by the cross pieces, in combination with the cutter levers—their knives, projecting pins—the whole being arranged in conjunction with the fulcrum."

221. For *Improvements in Rotary Steam Engines;* John B. Root, Brooklyn, N. Y.

*Claim.*—"The contrivance of the steam ports, passages and stop bars, arranged in connexion with the piston rollers so as to let the steam in upon the rubber, at different and opposite sides of the cylinder, at as many places as the number of rollers used shall require—thus acting upon the rollers at different and opposite points—thereby relieving the centre shaft from side pressure and friction, and also, increasing the power of the engine with the increase of the number of steam ports and piston rollers. Also, the arrangement and device of the movable plates and the stationary plates and collar, with the friction rollers and metallic bars or arms, for the purpose of adjusting the piston rollers."

222. For an *Improved Wrench;* Bradford Rowe, Albany, New York.

*Claim.*—"The solid movable jaw, sliding between the parallel side pieces, to which the fixed end jaw is attached. Also, the bevel wheel and screw-gearing to move the jaw, in combination with the solid movable jaw."

223. For an *Improvement in Breech Loading Fire Arms;* Simon F. Stanton, Manchester, New Hampshire.

*Claim.*—"1st, Raising the chambers into line with the barrel, by the action of revolving them. 2d, The peculiar form of the breech piece, with its elevated and depressed portions and inclined planes—whereby, as one charge chamber is raised into line with the barrel, the one last discharged is forced down by the inclined plane into its vertical position. 3d, The method of securing the chambers in position, without interrupting their motions, by means of the lever. 4th, The ring, constructed and operating for the purpose of arresting the motion of the revolving chambers, and closing the joint between the barrel and the chamber. 5th, The combination of the devices, whereby the ring is driven forward to release the charge chambers before they are revolved. 6th, The safety stop, for the purpose of preventing the fall of the hammer, whenever the ring is not drawn over the joint between the barrel and the charge chamber."

224. For an *Improvement in Reaping Machines;* Pliny Thayer, Lansingburg, N. Y.

*Claim.*—"In combination with the raker's stand and the usual platform for receiving the cut grain, the rearward inclination and extension of said platform from the line, so that the raker may move his rake with the natural sweep of his arms or body in raking the gravel from the platform."

225. For an *Improved Machine for Manufacturing Friction Matches;* Alexander Underwood, German Flats, New York.

*Claim.*—"1st, The cutting and rocking device formed of the several parts or elements. 2d, The manner or mode of feeding the blocks or billets of wood to the cutters by the alternate lateral shifting motion, the box caused through the intervention of the devices, combined with the fluted rollers, &c. 3d, The toothed or geared reciprocating crank device, with the combination parts and the dipping pan. 4th, The construction of the endless chain rack devices, formed with series of pins or teeth together, in combination with the intermittent rotary rack carrier and crank ratchet device. 5th, The boxing and capping device."

226. For an *Improvement in Box Openers;* Charles P. S. Wardwell, Lake Village, New Hampshire.

*Claim.*—"The employment of rotary dogs, or their equivalents. Also, the combined arrangement of the spring and flattened shanks of the dogs, whereby the wedge lips of the dogs are kept in the same line or parallel with each other for convenience of insertion, without hindering the desired rotary motion of the dogs."

227. For an *Improvement in Fire Arms;* Frederick Newbury, Albany, New York.

*Claim.*—"1st, The method of operating the block by the hammer, in combination with the forked lever, the spring, and recoil stop pin, reference being had to the peculiar form of the lever. 2d, The formation of the front trigger guard into a sear spring, and its attachment to the lower end of the trigger."

228. For an *Improvement in Machines for Paring Apples;* Ephraim L. Pratt, Philadelphia, Pennsylvania.

*Claim.*—"Attaching the lower end of the knife shaft to the stud projecting from the larger segment, by a flat steel or other spring, for enabling the said knife shaft to have

a slight vibration through the twisting or torsion of said spring, for the purpose of adapting the edge of the knife to the inequalities of the surface of the apple during the process of paring, and enabling the elasticity of the spring produced by the twisting or torsion of the same, to be exerted toward bringing the edge of the knife, when thus moved, back to its proper relation to the surface of the apples."

229. For an *Improvement in Self-Rakers for Harvesters;* Thomas T. Whitaker, St. Charles, Illinois.

*Claim.*—"1st, The rock-shaft, in combination with the rack and connecting shaft. 2d, In combination with the rake, the cradle. 3d, The method of adjusting the rake, so as to enable it to rake from platforms of different widths of cut."

230. For an *Improvement in Corn Planters;* Samuel Wilt and George W. Albaugh, Green Castle, Pennsylvania.

*Claim.*—"The use of the slide in corn planters, when provided with expanding grain receptacles."

231. For an *Improvement in Propelling Boats;* S. W. Wood, Washington, D. C.

*Claim.*—"The arrangement and combination of the horse power and paddle wheels, whereby the raising and lowering of the paddle wheels to suit the various depths at which the boat sinks, and produces variable inclination of the horse power, so as to enable the horse to exert a power proportioned to the weight of the load."

232. For an *Improved Lathe;* Albert H. Brown, Assignor to Tingley & Viele, Albany, New York.

*Claim.*—"The form and arrangement of the cutter stocks with the cutting tools attached, so as to partake of the curvilinear motion of the stock, and pivoting them upon the slide rest, in combination with the apparatus for transferring the lines of the pattern by the motion of the stocks to the cutters, so as to produce a turned surface of which the edge of the pattern is a sectional representation."

233. For an *Improvement in Machines for Cleaning Knives;* A. C. Ketchum, Assignor to Edward B. Olcott, City of New York.

*Claim.*—"Subjecting the knife blade while secured upon the bed piece to the requisite friction or rubbing, by means of the strips attached to the underside of the board."

234. For an *Improved Machine for Embossing and Printing;* Samuel W. Lowe, Philadelphia, Assignor to Jacob M. Beck, Harrisburg, Penna.

*Claim.*—"1st, The employment of two segmental rollers, in combination with a traversing frame or table—said table having a loose plate, by removing and replacing which, the said segmental rollers may be used for embossing for printing from engraved plates, for which a patent was granted to me, on the 18th of September, 1855, or for printing from common type. 2d, The radial adjustable arm, in combination with the lower segmental roller, for the purpose of limiting the distribution of the ink to the engraved plates attached to said rollers."

235. For an *Improvement in Harvester Fingers;* John Reily, Heart Prairie, Wis.

*Claim.*—"Hardening that part of the tooth on which the knife works."

### Additional Improvements.

1. For an *Improvement in Ventilating Railroad Cars;* George F. Foote, Buffalo, New York; patent dated July 11, 1854; additional April 8.

*Claim.*—"A small door that may be opened or shut, in connexion with, and as a part of a car window, that may be raised or opened in the usual way."

2. For an *Improvement in Grain Binders for Harvesters;* George W. N. Yost, Pittsburgh, Penna.; patent dated Jan. 1, 1856; additional April 8.

*Claim.*—"1st, The long lever, operated by projections and spring. 2d, The arrangement and combination with the cams for operating the compresser, the lever, bevel gearing, and pulley wheel on the pinion shaft. 3d, The guards."

3. For an *Improvement in Grass Harvesters;* George Esterly, Heart Prairie, Wisconsin; patent dated June 27, 1854; additional April 22.

*Claim.*—"Connecting the projections which are on alternate sections of the sickle to the bar, so that the said bar may be on top of said sections."

### Re-Issues for April, 1856.

1. For an *Improvement in Printing Presses;* George P. Gordon, City of New York; patent dated August 5, 1851; re-issued April 8, 1856.

*Claim.*—"1st, A rotating reciprocating platen, operating as described. 2d, The arrangement of two side arms, so combined as to form a frame to carry the inking rollers both forward and backward over the form for each impression. 3d, Throwing a vibrating bed from the point of its receiving the inking rollers directly to the impression by means of toggles arranged as shown, so that said bed after receiving the impression will be allowed to recede or fall back to its original position by its own gravity. 4th, The combination of the vibrating bed with the roller frame. 5th, The grooved cam-shaped guides, for throwing the frisket in the proper direction, and holding it in the desired positions during the intervals of rest given to the platen."

2. For an *Improved Mode of Constructing Walls and Floors of Cellars;* Augustus R. Moen, City of New York, patent dated Feb. 26, 1856; re-issued April 8.

*Claim.*—"The mode of forming walls and floors by combining into one mass the water cement and asphaltum, by means of the solid building materials, by which the asphaltum is caused perfectly to adhere to the bricks or stone of the wall built with a water cement which also adheres to the same stone or brick."

### Designs for April, 1856.

1. For *Clock Case Fronts;* Nicholas Muller, City of New York.

*Claim.*—"The female figure, peacock, and foliage, when arranged and combined as shown."

2. For *Parlor Stoves;* Samuel H. Ransom, Albany, New York.

3. For *Six Plate Stoves;* Samuel H. Ransom, Albany, New York.

4. For *Stove Plates;* Samuel H. Ransom, Albany, New York.

5. For *Cooking Stoves;* Samuel H. Ransom, Albany, New York.

6. For an *Elevated Oven Cooking Stove;* Samuel H. Ransom, Albany, New York.

Claims to Nos. 2, 3, 4, 5, and 6, the combination and arrangement of ornamental figures and forms, each forming an ornamental design.

7. For *Chandeliers;* Samuel B. H. Vance, City of New York, Assignor to Mitchell Bailey & Co., Connecticut.

*Claim.*—"The design, configuration, and arrangement of the several parts and ornaments."

8. For *Parlor Stoves;* N. S. Vedder and Wm. L. S. Sanderson, Assignor to Sanders, Wolfe and Warren, Troy, New York.

*Claim.*—"The ornamental design and configuration."

9. For *Metallic Pens;* Albert Granger, City of New York.

*Claim.*—"The device impressed on the pen, to wit: a medallion bearing a likeness of Washington."

10. For *Cooking Stoves;* Samuel H. Ransom, Albany, New York.

*Claim.*—"The combination and arrangement of ornamental figures and forms represented, forming together an ornamental design."

11. For *Gas Ovens;* Edward J. Delany, Assignor to Cresson, Stuart & Peterson, Philadelphia, Pennsylvania.

*Claim.*—"The design for gas ovens."

12. For *Summer Furnaces;* Jacob Beesley, Assignor to Cresson, Stuard & Peterson, Philadelphia, Penna.

*Claim.*—"The design for summer furnace."

13. For *Castors;* Wm. H. Green, Meriden, Connecticut.

*Claim.*—"The general design and configuration of the castor."

14. For *Stove Plates;* Harvey Smith and Frederick A. Sheldon, Troy, New York.

*Claim.*—"The design and configuration forming an ornamental design for stove plates."

15. For *Clock Case Fronts;* Nicholas Muller, City of New York.

*Claim.*—"The wreath and figures, arranged and forming a new and ornamental design."

16. For *Clock Case Fronts;* Nicholas Muller, City of New York.

*Claim.*—"The female figure, reclining or sitting upon the sheaves."

MAY 6.

1. For an *Improvement in Breech Loading Guns;* Edward Lindner, City of N. York.

*Claim.*—"1st, The application of a lever, projecting partly into the gun barrel, or of a piston forming part of the barrel, in such a manner, that the passage of the ball through the gun barrel, or the explosive power of the powder, shall act upon the same, pressing the same outwards, for the purpose of communicating motion to a rod, situated below the gun barrel. 2d, The manner of disengaging and opening the breech, by a motion obtained either by the passage of the cartridge through the gun barrel, or by the action of the expansive power of the powder when the gun is fired off. 3d, The box containing asbestos, or its equivalent, for the purpose of cleaning the rubbing surface of the breech in its motion upwards. 4th, The arrangement of packing the axis of the breech against the face of the gun nipple frame. 5th, The arrangement of the vent or priming hole, from the gun nipple to the cartridge chamber in the breech. 6th, Filling the space in the recess with asbestos, or its equivalent."

2. For an *Improvement in Repeating Fire Arms;* George Leonard, Shrewsbury, Mass.

*Claim.*—"The invention in fire arms of an expedient for connecting several eccentric barrels to a chamber having an equal number of bores, and for partially, but not wholly disconnecting the same, for the purpose of loading, cleaning, &c., consisting of a combination of a central screw, with a spindle, having a projecting head and a bore of two different diameters in the centre of the concentric barrels, the front part of the bore being larger than the back part, and of the diameter of the projecting head and the back part of the bore being smaller than the front part, and of the diameter of the spindle. I claim the invention in fire arms of a combination of a cocking lever, trigger, and sear, with a thumb piece; the combination to have such characteristics, that the fire arm can be uncocked without discharge, only by pressing said thumb piece, and easing down said cocking lever."

3. For an *Improvement in Machines for Figuring and Polishing Morocco;* Eugene L. Norton, Charlestown, Massachusetts.

*Claim.*—"The rotating tool for polishing or figuring leather, when such tool has imparted to it a greater velocity than that due to rolling simply."

4. For an *Improvement in Gas Burners;* James Neal, Boston, Mass.

*Claim.*—"Constructing the burner not only with a covered cup or stand reservoir, and a discharging pipe extending into said reservoir, but with one or more passages for the gas to flow around and into the cup, and through its loose sand or straining contents; my improvement enabling me to employ powdered quartz, or a loose mineral matter or substance, as a filter or strainer, and thereby attain advantages."

5. For an *Improvement in Machines for Sawing Marble Kerfs of Varying Angles;* Samuel Nickelson, Pulaski, Tennessee.

*Claim.*—"The adjustable or sliding bars, when said bars are curved or bent, so as to form saw frame guides, in combination with the pivoted pitmans and eccentrics on the shafts, whereby the saw frames and the devices for drawing them are all attached to and move with the bars; thereby allowing the saws to be adjusted more or less angularly with each, and at required distances apart, with the greatest facility."

6. For an *Improvement in Preparing Artificial Stone;* Robert Neisch, City of N. York.

*Claim.*—"The preparation of artificial stone, by treating plaster of Paris, previously calcined, together with sulphuric acid, with solutions of alum and carbonate of ammonia."

7. For an *Improvement in Ovens;* Jesse Ohmert, Mt. Morris, Illinois.

*Claim.*—"The arrangement of the flues and spaces relatively with the fire chamber and oven."

8. For an *Improved Apparatus for Lubricating Grist Mill Spindles;* Clayton Brown, Sen., Richmond, Indiana.

*Claim.*—"The oil chamber, with tube attached; the tube being provided with a stop-cock, and the chamber with a piston or follower, the inner end of the tube passing through the bush."

9. For an *Improved Rotary Shingle Machine;* C. F. Beverly, Lancaster, Ohio.

*Claim.*—"Securing the knives or cutters to the wheel or disk, by means of the bolts which pass through the knives or cutters near their cutting edges, and through the ears at the ends of the plates, the heads of said bolts being beveled and employing the screws for securing the ears to the bars attached to the wheel or disk, and adjusting the knives or cutters by means of the screws which pass through the bars. I further claim the bar, attached to the elastic bars, by rods which work in slotted rails at the ends of the platform or bed; the lower ends of the bars being connected to the rock shaft, having a treadle attached to it, and against which treadle a spring acts, for the purpose of feeding and properly presenting the block to the knives or cutters."

10. For an *Improved Construction of Guides or Chutes for Turbine Wheels;* Joseph Bastion, Theresa, New York.

*Claim.*—"The stationary conical centre, in combination with the adjustable parts and supporters, for the purpose of graduating the quantity of water discharged, and giving the desired direction to the same."

11. For an *Improved Wagon Tongue;* J. T. Baughman, Frazeysburgh, Ohio.

*Claim.*—"1st, Constructing the tongue in two separate parts. 2d, The arrangement and combination of the hounds for the purpose of connecting the tongues together."

12. For an *Improved Vise;* Charles Buss, Marlboro', New Hampshire.

*Claim.*—"1st, Making the movable jaws with the parts extending beyond the joints, so as to be operated by the wedge, or its equivalent. 2d, Making both jaws movable so as to open equally, and hold the various sizes on a line with the centre of the whole tool."

13. For an *Improvement in Self-heating Smoothing Irons;* G. W. Bishop, Brooklyn, New York.

*Claim.*—"The tubes or pipes, placed one at the front, and the other at the back of the fire chamber or box, and the openings or holes at the sides of said chamber or box. Further, the hollow projection attached to the fire chamber or box, and communicating with said chamber or box, by an aperture, and having a tube connected with it, which communicates with the external air, at one side of the fire chamber or box."

14. For an *Improved Lubricator;* Abel Breaer, Saugatuck, Connecticut.

*Claim.*—"The attachment of the syringe directly to the plug of the cock."

15. For an *Improvement in Double Panel Shutters;* Charles S. Bruff, Baltimore, Md.

*Claim.*—"The combination of the double panel shutters, with the wire netting inserted between the panels, as an effectual bar against the admission of mosquitoes, or other insects, into buildings, and sparks and cinders in railroad cars, &c."

16. For an *Improvement in "Pegging Jacks," or Shoemakers' Head Blocks;* Thomas D. Bailey, Lowell, Mass.

*Claim.*—"1st, The method of fastening the turn-table to the block, by means of the screw and spring. 2d, The peculiar construction of the wedge, having a convenient handle-pawl attached to it, which pawl plays into a ratchet made in the turn-table or bed plate."

17. For an *Improvement in Machines for Paring Apples;* John D. Brown, Cincinnati, Ohio.

*Claim.*—"The projections on the impelling wheel frame, when the wheel is hung on a centre, within the circle of action of the projections, and sufficiently eccentric to the frame for the escape of one projection over the other."

18. For an *Improvement in Corn Planters;* Reinhold Boeklen, Jersey City, N. J.

*Claim.*—"The employment of one or more covering plates applied in connexion with the seed-box or tube, and the plunger, and operating to lift a quantity of earth, and deposit over the corn which has been planted."

19. For an *Improved Machine for Sawing Felloes;* S. and Wm. H. Book, Rushville, Ohio.

*Claim.*—"Hanging the saw, by means of adjustable arms, to a horizontal shaft or angle, thereby allowing the saw to descend by its weight through the circular path forming the curvature of the felly."

20. For an *Improved Mould Press for Horse Collars;* Melvin C. Chamberlain, Shelden, New York.

*Claim.*—"Giving shape and form to horse collars, by means of a mould press."

21. For an *Improvement in Processes for Making Paper from Straw;* Wm. Clark, Dayton, Ohio.

*Claim.*—"The boiling of coal tar in with the straw, or other vegetable material, for the manufacture of paper."

22. For an *Improved Hydrant;* C. J. Cowperthwaite, Philadelphia, Pennsylvania.

*Claim.*—"1st, The employment or use of the case or protector, so connected with the valve rod, that the valve will be opened when the case or protector is moved aside, to expose the nozzle; and the valve closed when the case or protector is moved over the nozzle. 2d, The slide valve, arranged or applied to the cistern; the valve being fitted within the cistern, and connected with the rod, through the waste water passage, whereby the valve is made to work water tight, and the use of a stuffing box and packing avoided. 3d, Securing the cistern, with the pipe and valve attached within the case, by means of a rod, whereby the above parts may be readily detached from the case, and secured within it."

23. For an *Improvement in Lard Lamps;* Samuel Davis, New Holland, Penn.

*Claim.*—"A tube, with a cone-shaped feeder and lard heater in, two segments, (to admit of a double wick,) with its apertures, and the aperture in the stem, all in combination."

24. For an *Improved Machine for Splitting Wood;* Charles Day, Lancaster, and Alanson D. Lord, Bethany, Assignors to Charles Day, Lancaster, New York.

*Claim.*—"The particular application of the axes."

25. For an *Improved Self-Regulating Wind-Mill;* Albert G. Field, Quincy, Illinois.

*Claim.*—"Hanging the sails on arbors, or spindles, and having the weights attached to the cranks of the arbors or spindles, by cords having buttons upon them. Further, raising the weights, by means of the cords attached to the weights and shaft, or pin."

26. For an *Improved Road Scraper;* John Gustine and I. M. Rankin, Lewiston, Ill.

*Claim.*—"The beam, sliding through bands upon the tongue, attached by the chains to the scraper, and operated and made fast by withdrawing or inserting the pin."

27. For an *Improvement in Potato Diggers;* Abram Hewlings, Philadelphia, Penn.

*Claim.*—"The combination of the excavator and inclined open bed, with the series of rakes, so connected with the endless carrier, that the rake-teeth will be projected to the front of the excavator, at, or nearly at, a right angle to its surface, and have a motion of translation along the bottom of the same, previous to reaching the inclined bed."

28. For a *Process for Preparing Elastic India Rubber Cloth;* Nathaniel Hayward, Colchester, Connecticut.

*Claim.*—"The producing an elastic fabric, of uniform strength, by uniting a sheet of rubber with sheets of cloth, thinly coated on one side with a vulcanized compound

of rubber; the sheet of rubber before it is united with the sheets of cloth, being in the modes so prepared, that the central part of it is completely vulcanized, while the surfaces are not."

29. For an *Improvement in Bagasse Furnaces;* Abram Hager, Baton Rouge, and Youngs Allyn, New Orleans, Louisiana.

*Claim.*—"The application to bagasse furnaces, of a skeleton arch, which will retard the bagasse in falling direct on such portions of the fuel in a state of combustion, or in any other mode substantially the same, which will produce the same effect."

30. For an *Improvement in Salt Evaporators;* Benjamin Hood, Albany, New York, and E. P. Monroe, Charlestown, Massachusetts.

*Claim.*—"The construction of an evaporating apparatus, of two concentric rotary cylinders, supplied with liquid, heated and operated to effect evaporation from the weaker portion of the liquid, and economizing fuel."

31. For an *Improvement in Making Gum Elastic Cloth;* Henry G. Tyer, Ballard Vale, Mass., and John Helm, New Brunswick, N. J.; ante-dated January 9, 1856.

*Claim.*—"An elastic fabric, composed of two pieces of cloth, either woven with the threads of the weft in a diagonal position to the threads of the warp, or of common cloth, stretched, so as to force the threads in such relative diagonal position combined, and caused to adhere together, exclusively, by a vulcanized compound of india rubber or gutta-percha; the two pieces of cloth being first united by the vulcanized compound, and the compound being vulcanized after the union."

32. For an *Improvement in Manufacturing Felted Yarns;* Moses A. Johnson, Lowell, Massachusetts.

*Claim.*—"The arrangement of the steam rubber in relation to and in combination with the endless apron."

33. For an *Improvement in Dumping Scrapers;* Matthew S. Kahle, Lexington, Va.

*Claim.*—"So attaching the body of the scraper permanently to a but axle, supported in a pair of wheels, as that said body may be dumped and returned back to its original position, and ready for its next load, without stopping the horses, or changing their direction.

34. For an *Improvement in Washing Machines;* James T. King, City of New York.

*Claim.*—"The construction of a rotary cylinder in connexion with internal and external pipes, arranged in such a manner, that through said pipes steam can always be let into the lower part of the cylinder, and escape at the top, while the cylinder is in motion or stationary; and that by the same arrangement, hot water, cold water, or steam can be let into the cylinder at the top, and escape at the bottom, while said cylinder is in motion or stationary."

35. For an *Improvement in Machines for Sowing Clover Seed;* Matthew S. Kahle, Lexington, Virginia.

*Claim.*—"In combination with a gathering and conveying apparatus such as described, the rubber and meshed wire concave, for separating and throwing out the grass, leaves, weeds, and other impurities from the heads, pods, &c., and passing the latter to the threshing cylinder, and concave, and blast, and screen underneath them."

36. For an *Improved Method of Hanging Gates, Doors, &c.;* Samuel Uberholyer, Terre Hill, Pennsylvania.

*Claim.*—"The arrangement of the pawl, and pawl holder, with each other, and with the levers, the ratchet wheel, the pinion, and the rack bar."

37. For an *Improvement in Furnaces for Smelting Iron;* Thomas H. Powers, Wyocena, Wisconsin.

*Claim.*—"So arranging the pipe in connexion with the combustion chamber and stock, that the air passing through the pipe shall be heated and discharged."

38. For an *Improvement in Cooking Apparatus;* George Pierce, City of New York.

*Claim.*—"The employment of the double oven, arranged and combined with the roasting apparatus."

39. For an *Improved Machine for Manufacturing Barrel Heads;* N. W. Robinson, Keesville, New York.

*Claim.*—"1st, The peculiar construction of the clamp, as herein shown and described, viz: said clamp being formed of a ring, having segments attached to its under side by set screws placed between the upper surface of the segments and under surface of the ring, by which construction the clamp may be enlarged or contracted so as to suit different sized barrel heads. 2d, I claim the stationary bed piece, and rotary planing disk, in combination with the sliding clamp, for the purpose of allowing said planing disk to plane and chamfer the whole surface of one side of the barrel head, and then support it in its position while being chamfered, and planed on the other side."

40. For an *Improved Machine for Extracting Stumps;* Solomon W. Ruggle, Fitchburgh, Massachusetts.

*Claim.*—"The lever frame, operated by the lever, pawls, ratchet, and strap, when the above parts are attached to the sled."

41. For an *Improvement in Extension Wagons;* Ephraim D. Rosencrantz, City of New York.

*Claim.*—"The employment of the slide bars, when used with the bars."

42. For an *Improvement in Compositions for Stuffing Leather;* John Rose, Newark, New Jersey.

*Claim.*—"Softening leather by stuffing it with a compound of paste, made of rye, or other meal, bees-wax, rosin, molasses, and oil, or other fatty matter."

43. For an *Improved Hoop Machine;* Joseph and Sylvester Sawyer, Fitchburgh, Mass.

*Claim.*—"1st, The combination of the rest and the pressure roll, with the hollow faced cutter head. 2d, The method of tapering the hoop for the lap by means of the lever and spring top."

44. For an *Improved Door Fastener;* Willard H. Smith, City of New York.

*Claim.*—"The use of the screw nut, working on the hinged stem as a means of adjustment of the plate, when employed in combination with the staple hook."

45. For an *Improvement in Heating Feed-water Apparatus for Steam Boilers;* Thos. Sloan, St. Louis, Missouri.

*Claim.*—"1st, A vessel separate from the boiler, but communicating both with the steam and water chambers thereof, in which the water, previously to its entrance to the boiler, is heated by passing in a thin stream in its upper part, and also by the contact of the steam with the top of the body of water contained therein. 2d, The arrangement of the purifying vessel, the pipe with its funnel-mouth, the internal heating chamber, and the pipes."

46. For an *Improvement in the Construction of Artificial Legs;* Wm. Selpho, City of New York.

*Claim.*—"The semi-cylindrical joints fitted with the pipe and pin, to connect said joints together, and give facility for lubricating the same. Also, in combination with said semi-cylindrical joints, the elastic cushion at the ankle joint. Also, attaching artificial toes of india rubber to the wooden part of the foot."

47. For an *Improvement in Machines for Sowing Seed Broad-Cast;* Enos Stimson, North Craftsbury, Vermont.

*Claim.*—"The rotating horizontal arm or tube, provided with valves at its ends, and used in connexion with the adjustable board or plate, provided with the semi-circular recesses."

48. For an *Improvement in the Ladling of Molten Glass;* Wm. P. Walter and Jacob Green, Philadelphia, Pennsylvania.

*Claim.*—"The employment of a suspended ladle for facilitating the manufacture of glass."

49. For an *Improvement in Marble Sawing Machines;* A. F. Ward, Louisville, Ky.

*Claim.*—"Suspending the saw frames or sashes within the frames, by means of the chains which are attached to rack bars, having weights or counterpoises connected to them, the rack bar being connected by pinions with rack bars, to which the connecting rods of the saw frames or sashes are attached."

50. For an *Improvement in Sheep Shears;* Robert M. Wilder, Coldwater, Michigan.

*Claim.*—"The rotary cutter, in combination with the spring handle, coupling rods, levers, spring pawls, spur wheel, and wheels connecting spur wheel with cutter wheel, or equivalents thereof.

51. For an *Improvement in Railroad Car Seats;* George Willard, Boston, Mass., Assignor to self, and W. C. Jameson, Antrim, New Hampshire.

*Claim.*—"The combination of the divergent mortises, or their equivalent, the guide groove and the projection as applied to the seat holder, and the journal, provided with a tenon, and arranged in a stand. Also, combining with supporting socket or stand, and the chair seat or chair, the lateral bearers and legs, each provided with feet."

52. For an *Improvement in Scythe Fastening;* Denison W. Green, Assignor to self, and Aretas Ferry, Bernardstown, Massachusetts.

*Claim.*—"The combination of the adjustable wedge and cam lever, as applied to the binding stirrup and snath."

53. For an *Improvement in Propellers for Life Boats;* George W. La Baw, Jersey City, N. J., Assignor to self, and Joseph Collon, City of New York, and T. Howell, Ewing Township, New Jersey.

*Claim.*—"Constructing the propellers with blades on both sides, so as to enable the boat to be worked by the same mechanism when either side up."

54. For an *Improved Saw-Mill Dog;* George W. Hill, Assignor to self, and Francis Lyons, Waverly, New York.

*Claim.*—"The peculiar form of the bail block, having a front and back rest or bearing in connexion with the arm, clasping the shaft of the screw. Also, the die or dies in connexion with the spring bar, the rest, and the guard."

55. For an *Improvement in the Manufacture of Machine Bricks;* S. W. Wood, Washinton, D. C.

*Claim.*—"Moulding brick by concussion, whether it be by this or any other mechanism."

56. For an *Improvement in Machinery for Felting Hat Bodies;* James S. Taylor, Danbury, Connecticut.

*Claim.*—"The vibrating rubber or bed, in combination with the rubber, having a positive movement or rotation on their own axis given them in a direction causing the outer points of their peripheries to travel in the direction of their general travel, as acquired by the rotation of the central shaft."

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57. For an *Improved Riffle for Gold Washing;* Ossian G. Auld and Jasper S. Whiting, Stockton, California.

*Claim.*—"The use of circular cavities or receptacles having the neck of one diameter, and the lower portion of an enlarged diameter."

58. For an *Improvement in Locks;* William H. Akins, Berkshire, New York.

*Claim.*—"1st, So arranging a series of revolving slotted disks upon a fixed neck or stud, that each, in turn, shall be made the means of adjusting the slot of the other, when operated upon by another disk secured to a revolving shaft and index. 2d, Altering the respective numbers of two or all the disks, by the simple change of an adjustable clutch from one hole to another. 3d, The method of discovering the proper numbers to open the lock."

59. For an *Improved Cartridge Opener;* Jesse S. Butterfield and Simeon Marshall, Philadelphia, Pennsylvania.

*Claim.*—"The combination of a steady pin, thumb-piece, toothed saw, and spring, attached to the upper band of the gun."

60. For an *Improved Farm Gate;* Charles N. Cole, Pleasant Valley, New York.

*Claim.*—"The arrangement and combination of the parts forming a self-acting or balance gate."

61. For an *Improvement in Wardrobe Trunks;* William J. M'Craken, Rochester, N. Y.

*Claim.*—"The construction and arrangement of the supporting strips in the portion of the trunk, for limiting the sliding portion of the wardrobe to the part of the trunk."

62. For an *Improved Planing Machine;* Cyrus B. Morse, Rhinebeck, New York.

*Claim.*—"1st, The combination of the following mechanical elements: planing cylinders, line plate, beds or rests, and weighted levers, when arranged and combined for reducing a board to an equal thickness, without bending the same. 2d, Making the edge of the bed a cutting instrument, and giving said bed or rest a longitudinal movement, simultaneous with the swinging back or forward of the cylinder, so that the edges of the cutters on the cylinder will preserve the same relative position, with respect to the cutting edge of the bed, in all positions which the said cylinder may occupy. 3d, Giving the line plate a tilting motion about its own axis, to present its flat surface to the board under all circumstances. 4th, Maintaining the pressure on the middle of the board, irrespective of the portion of the cutters to which the board is submitted, by means of the weighted levers."

63. For an *Improved File Cutting Machine;* James L. Norton, Alum Bank, Penna.

*Claim.*—"1st, Hanging the worm wheel shaft in movable bearings, so the worm may be disengaged from the feeding rack, without stopping its motion to do so, for the purpose of allowing the carriage to run back and be set for the next series of nicks. Also, in combination with the movable shaft, the adjustable projection and levers, for first holding and then disengaging the shaft, to admit of its swinging. Also, in combination with the sliding carriages, the projection and adjustable former, for keeping the blank at an uniform distance from the nicking tool, for the purpose of equalizing the force of the blow, notwithstanding the taper of the blank. Also, the use of the spaces for regulating the force of the spring upon the nicking tool."

64. For an *Improved Reacting Water Wheel;* George W. Pittock, John B. Stott, and Galen Richmond, Troy, New York.

*Claim.*—"The combination bucket, formed by the union of two separate buckets, whose lines are arranged so as to form a hollow box, through which the water passes in operating the wheel. Also, the mechanical arrangement and application of the gearing to the wheels and shaft within the upper section of the cone of the upper wheel, in combination with the cap which it covers."

65. For an *Improvement in Brooms and Brushes;* Thomas H. Powers, Wyocena, Wis.

*Claim.*—"The frame composed of links and rods, which surround the broom, and hold it in connexion with the cone."

66. For an *Improvement in Apparatus for Heating Buildings by Steam;* A. S. Pelton, Clinton, Connecticut.

*Claim.*—"The construction of the apparatus with annular chamber around the fire pot, and constituting a portion of the channel from the boiler to the radiator, for warming the air in the radiators, previous to the generation of steam."

67. For an *Improvement in Snow Ploughs for Railroads;* Samuel Richards, Philadelphia, Pennsylvania.

*Claim.*—"1st, The construction of a snow clearer, of a simple rising inclined plane, in combination with the curved pieces, so arranged, that the snow shall be gradually raised at or near to the surface of the surrounding snow, and then discharged over on the top of it. 2d, The employment of a series of pipes or other heating apparatus, in the interior of a snow-clearer, for the purpose of diminishing the adhesion of the snow to the upper surface of the clearer."

68. For an *Improvement in Making Brass Kettles;* Frederick J. Seymour, Waterbury, Connecticut.

*Claim.*—"Forming brass kettles or similar articles, from disks of metal, by the successive operations; commencing at the bottom and smaller part of said kettle, and shaping the same at once, and then gradually forming a drawing in the sides, by means of dies."

69. For an *Improvement in Gas Ovens;* John Starrett and Newton J. Wier, Lowell, Massachusetts.

*Claim.*—"1st, The distributor plate. 2d, The combination of the distributor plate,

the chamber with its net-work and covering, and the exterior cases. 3d, The combination of the plates or registers with the net-work covering of the chamber, for the purpose of varying the surface of combustion, to suit the various utensils to be heated."

70. For an *Improvement in Machines for Preparing Dough for Moulding Crackers;* Francis C. Treadwell, Jr., City of New York.

*Claim.*—"The use of the cutters in combination with the throat, for the purpose of making a shear cut, when used in combination with the grooved rollers."

71. For an *Improvement in Chairs for Ships' Cabins;* William Thomas, Hingham, Massachusetts.

*Claim.*—"Suspending or attaching the chair to the curved bar, which is connected to the base by means of the arms and curved bar."

72. For a *Fire and Escape Ladder;* John Van Amringe, Cincinnati, Ohio.

*Claim.*—"The combination of the ladder, frame, and guy chains, as attached to the frame work—and these in combination with the pulley and rope, for elevating the *latter* and frame. Also, the arrangement of the guiding shafts, arranged with the two sections of the framing and the windlass, and the cord connected therewith, and to one of said sections, for drawing the two sections apart and together."

73. For an *Improved Furnace for Heating Soldering Irons;* James Wilson, Brandywine, Delaware.

*Claim.*—"Constructing a furnace, and providing it with any desirable number of cells, for the purpose of heating soldering irons with anthracite or other coal."

74. For an *Improved Horse Shoe;* Nelson B. Carpenter, City of New York.

*Claim.*—"A horse shoe, having a branch bar attached to each heel bar of the shoe, extending inwardly, and at the same time lapping and fitting one to the other, with corresponding apertures through each, for the insertion of a pin or screw."

75. For an *Improvement in Surgical Splint;* John Clough and Daniel M. Cummings, Enfield, New Hampshire.

*Claim.*—"1st, The bed, composed of strips of cotton cloth, or other suitable material, passing through slots in the leg side piece. 2d, The foot frame and bed, composed of the oblique standards, the bow and the strip of cloth, or other suitable material, passing through the slots attached to, and adjustable upon the leg side pieces. 3d, The device for extending the leg by the employment of the lower extension screw, the traversing nuts and their guides, with their connecting straps, in combination with the cross bars, the leg side pieces, the femur side pieces, the femur splint, the cushions, the bolster, the bandages with their connecting straps, and the brass straps. 4th, The device for extending the thigh, by the employment of the upper extension screws, in combination with the femur side pieces, by the leg side pieces, the femur splint, the cushions, the bolster, the bandages, with their connecting straps and the brass straps. 5th, The device for flexing and extending the limb, by the employment of the elevating screw and its supports, in combination with the cross-bar, the leg side pieces, the femur side pieces, the supports, the braces, the elongating arbor, the concave flooring, and the bed pieces. 6th, The elongated arbor. 7th, The device for spreading and contracting the splint, by the employment of the elongated tenon passing through corresponding mortises in the lower ends of the bed pieces, in the double elongated tenons firmly fixed in the upper ends of the bed pieces; and passing through a corresponding mortise in the upper end of the bed piece and the confining pin, in combination with the bed pieces, and the supports, and the braces, the elongating arbor, the femur side pieces, the leg side pieces, and the cross-bars."

76. For an *Improvement in Continuous Sheet Metal Lathing Surface;* John B. Cornell, City of New York.

*Claim.*—"A continuous sheet metal lap surface formed of united strips or sections."

77. For a *Machine for Cutting Green Corn from the Cobs;* William B. Coates, Philadelphia, Pennsylvania.

*Claim.*—"The spindle, with any convenient number of prongs, in combination with the yielding cutters."

78. For an *Improvement in Bridle Bits;* Benjamin J. Day, Gibson County, Ind.

*Claim.*—"The screw, the spring folding limb, by which the common curb and lever bit, and the non-curb and lever bit can be changed at pleasure from one to the other."

79. For a *Self-Counting Measure;* Elisha Dexter, Holmes' Hole, Mass.

*Claim.*—"Supplying the point which marks the extremity of the yard or standard of measure with the pressure knob, and connecting it with the pointer by means of the escapement lever and the rack, as a means of pointing out the number of yards measured upon the index."

80. For an *Improvement in Machinery for Trebling Single Thread;* Lucius Dimock, Hebron, and Ira Dimock, Mansfield, Connecticut.

*Claim.*—"1st, The rock shaft, with a hollow conducting arm, operating to conduct each strand of the thread from its bobbin, to the hitching pin, and to effect the enchaining of the loops. 2d, The attachment of the hitching pin or pins to the arm or arms of a rock shaft, which is operated for the purpose of forming, and disengaging the loops. 3d, The arrangement and combination of the rock shaft, having a hollow conducting arm or arms, the traveling carriage carrying the rock shaft, and its vibrating hitching arms, the strand bobbins, and the trebled thread spools."

81. For an *Improvement in Machines for Dressing Mill Stones;* Simon W. Draper, South Dedham, and Reuben M. Draper, Roxborough, Massachusetts.

*Claim.*—"In combination with the inversion of cam, the employment of a secondary lever, attached to the sliding piece, or arranged in any equivalent manner, to cross the face of the cam, on one side of the centre, and transmit motion therefrom to an arm on the pick shaft, whereby, in all changes of the relative positions of the pick shaft and the cam, the pick is operated by the cam in such a manner as to give an uniform force to the blow."

82. For an *Improved Bow for Violins;* Samuel F. French, Franklin, Vermont.

*Claim.*—"The attachment of a portion of the hair of the bow to a movable pin, operating to separate the said portion of the hair from the main body of hair in the bow, to unite it therewith, at the pleasure of the player."

83. For an *Improvement in Self-raking Attachments to Harvesters;* Hugh Foresman, Enon, Ohio.

*Claim.*—"The combination of the wheel, adjustable crank, slotted rake, and guides or ways, for giving the rake its traversing and rising and falling motion."

84. For an *Improvement in Hat Felting Machines;* A. C. Fuller, Danbury, Conn.

*Claim.*—"The polygonal drum."

85. For an *Improved Hand Saw;* Jackson Gorham, Bairdstown, Georgia.

*Claim.*—"The construction of a saw, so as to answer the purpose of both saw and square, in one and the same instrument."

86. For an *Improved Husking Thimble;* J. H. Gould, Smith, Ohio.

*Claim.*—"The device resembling the end of a human finger, and formed by providing a thimble, very simple in construction to a sewing thimble, and welding or otherwise forming an artificial finger-nail, on the upper side of its forward extremity."

87. For an *Improvement in Winnowing Mills;* Horace N. Goodrich, Aurora, Ill.

*Claim.*—"The arrangement of the screen, above the ordinary screens and shoes of a common farming mill, and furnishing a regulated blast to said series of screens, either from the main fan wheel, or an auxiliary wheel near thereto, for the purpose of comprising within one machine or frame, the facilities of cleaning all kinds of grain or seeds, and separating them from each other, and from the impurities mixed with them."

88. For an *Improved Punching Machine;* Edward Heath, Fowlersville, New York.

*Claim.*—"Placing a series of punches of varying sizes and forms, in a flanched rotating cylinder, arranged relatively with the plunger rod, so that by rotating the cylinder, either of the punches may be brought in line and connected with the plunger rod."

89. For a *Fastening for Port-monnaies and Pocket Books;* James Hewson, Newark, New Jersey.

*Claim.*—"The combination of the catch or swivel, the spring with the ring attached to the port-monnaies or pocket book frame."

90. For an *Improvement in Lock Joint for Railroad Cars;* James R. Hilliard, Paterson, New Jersey.

*Claim.*—"The combination of the several laps, consisting of, 1st, The lapping each against the other, along a central, longitudinal, vertical plane, or nearly so; 2d, Lapping each on to or under the other, on planes parallel or nearly so, with the longitudinal axis of the rail; and, 3d, Making the surfaces where each lap on and under the other, inclining downwards from each side of the rail, towards the central longitudinal vertical plane of division of the joints."

91. For *Improved Machinery for Manufacturing Washboards;* I. B. Holmes, Cincinnati, Ohio.

*Claim.*—"The arrangements of the cams, spring, and ring, for operating incising knife or cutter. Also, the arrangement of the guide piece and gauge piece."

92. For an *Improvement in Compound Rail for Railroads;* William J. Holman, Indianapolis, Indiana.

*Claim.*—"The extension at sundry points throughout its length or lengths, by waved or irregular formation of the stem or flanch of the cap bar of the tripartite rail, below and through or beyond the bottom surface of the two side or chair rails, and in connexion and combination therewith by a key, or wedge, passing through the one rail only, from below."

93. For an *Improved Method of Securing Knives to Cutter Heads;* William D. Hooker, Dedham, Massachusetts.

*Claim.*—"The cutter head, the shanks of the cutters, the wedge, the screw-rod—the whole in combination."

94. For an *Improvement in Invalid Chairs;* Daniel W. James, New Market, Va.

*Claim.*—"The construction of invalid chairs of a loosely jointed frame, in combination with a brace."

95. For an *Improvement in Mowing Machines;* C. M. Lufkin, Ackworth, N. H.

*Claim.*—"The employment or use of the endless aprons, in connexion with the rotating cutters."

96. For an *Improvement in Fastening Bits;* Horace Lettington, Norwich, N. Y.

*Claim.*—"The rod or arbor, passing transversely through the stock or bit, a portion of the socket, the rod or arbor having a notch in one side, and the shank of the notch also having a notch in one side, and the rod having a bolt passing against it."

97. For an *Improvement in Portable Chairs;* Zebulon Lyford, Lowell, Mass.

*Claim.*—"The self-operating folding portable chairs, or its mechanical equivalent."

98. For an *Improvement in Working Sheet Metal;* Sylvester B. Miller and Ezra W. Whitehead, Newark, New Jersey.

*Claim.*—"The employment of the die, when constructed and used in connexion with the lower die, for extending or stretching thin metal plate by pressure and rotary motion combined."

99. For an *Improvement in Brick Machines;* Edmund Kingsland, City of New York.

*Claim.*—"1st, The oscillating finisher, provided with a pair of fixed, and a pair of movable bearings, and operating in combination with a mould cylinder containing flat faced moulds, for the purpose of finishing the bricks with flat outer surfaces. 2d, The employment for varying the depth of all the moulds simultaneously, to vary the thickness of the bricks of the two cones, the right and left-handed screw shaft, operating in combination with the inclined edges on the piston bars."

100. For an *Improvement in Blow Pipes;* Oliver L. Lawson, Crestline, Ohio.

*Claim.*—"In combination with the adjustable valve in the cylinder, the adjustables E, in the tube D, so that a regulated blast may be had, whether sharp or mild."

101. For an *Improvement in Gas Regulators;* Henry Waterman, Hudson, New York.

*Claim.*—"The construction of the valve of the gas regulators, in the annular or ring form, with two faces or leats of different diameter; one at the outer, and one at the inner periphery or edge, so as to produce greater circumferential capacity or opening for discharge of gas, with a limited area of valve relatively."

102. For an *Improvement in Seeding Machines;* Hosea Willard, Vergennes, Vt.

*Claim.*—"The rotating cylindrical frames or screens, in combination with the inclined board or plate, with pivoted cleats attached for the purpose of distributing the seed, and the cylinders or rollers having teeth or shares attached to their peripheries."

103. For an *Improvement in Ovens for Cooking Ranges;* Jacob S. Williams, St. Louis, Missouri.

*Claim.*—"The employment of removable ovens, provided with unconnected compartments of various sizes and forms, and arranged so that said ovens may be substituted one for another, or be inserted in different portions, for the purpose of subjecting their compartments to different intensities of heat, according to the nature of the viands to be cooked thereon."

104. For an *Improvement in Locks;* Joseph M. Lippincott, Pittsburgh, Pa.

*Claim.*—"The combination of the spring bolt, tumblers and fence, together with the combination therewith of the locking-bolt and latch-bolt, so that the lock may be readily opened from inside, without a key, and yet requiring a key to open it from the outside."

105. For an *Improvement in Rolling File Blanks;* James N. Aspinwall, Assignor to self and Henry E. Staff, Newark, New Jersey.

*Claim.*—"The use of the rollers for forming file blanks, when said rollers are operated and adjusted by the slide, cam, and spring."

106. For an *Improvement in Mowing Machines;* Jonathan F. Barrett, North Granville, N. Y., Assignor to Abram B. and Jonathan R. Barrett, Lincoln, N. C.

*Claim.*—"The combination of guard plates, covering plates, and saw connexion to pinion, whereby the driving mechanism is effectually excluded from foreign matter."

107. For an *Improved Cutter Head for Lathes;* Milton Roberts, Assignor to self and Isaac N. Felch, Belfast, Maine.

*Claim.*—"The eccentric insertion of the tenon of the cutter-head in the mandrel, to produce an eccentric motion in throwing out the edge of the cutter."

108. For an *Improvement in Frames for Traveling Bags and Mail Pouches;* Samuel D. Quimby, Winchester, Assignor to Edward A. Locke, Boston, Massachusetts.

*Claim.*—"The improved mouth frame or combinations of two folding side frames, and two hinge extenders and gore closers, arranged, connected, and made to operate together."

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109. For an *Improvement in Machines for Cutting Meat;* Gustavus V. Brecht, St. Louis, Missouri.

*Claim.*—"The roller, as constructed of a series of circular plates having teeth or hooks on their peripheries—when said plates are put on a twisted square shaft—thus making rows of teeth of the edges of the several plates, and by the twist of the shaft, giving them a spiral form."

110. For an *Improvement in Water Closets;* Edward Bookhout and Chas. Hewlett, City of New York.

*Claim.*—"1st, A bowl, having the forward and backward motions, by means of the said bowl and waste working on a shaft or arms. 2d, The use of the pan, in combination with a movable bowl."

111. For an *Improved Boat Framer;* James Beetle, New Bedford, Mass.

*Claim.*—"The boat framer, as composed of the sets of adjustable and extension bars, and connecting contrivances, viz: the keel rests, bars, and their screws."

112. For an *Improvement in Pill Machines;* Henry C. Chapman, Albany, N. York.

*Claim.*—"The feeding cylinder, the knife, and the grooved bed piece, and the two grooved cylinders, having their surfaces driven at different rates of speed."

113. For an *Improvement in Fire Arms;* Samuel Colt, Hartford, Connecticut; patented in England, March 3, 1853.

*Claim.*—"Combining with the driving pin or bolt, and with the series of diagonal and longitudinal grooves, for rotating the breech and holding each chamber in line, during the discharge, the series of short longitudinal grooves, for locking the rotating

breech, so that the hammer can rest on the solid metal between two chambers, instead of the nipple, to prevent accidental discharges. Also, in combination with the said driving pin or bolt and the series of longitudinal and diagonal grooves, the lateral grooves or inclined planes, to admit of turning the breech by hand, when the hammer is at half cock."

114. For an *Improved Arrangement of Supplemental Valves for High-pressure Steam Engines;* Richard Colburn and L. W. Hanson, Norwich, Conn.

*Claim.*—"The self-acting valves connected together, for the purpose of freeing the cylinder of water, and of back steam."

115. For an *Improved Printing Machine;* John H. Cooper, Philadelphia, Penna.

*Claim.*—"In combination with a type wheel, having its types radially arranged thereon and operated, the presser bar, for carrying the paper to the type, to receive the impression. Also, the manner of connecting and disconnecting the paper carriage and endless belt, together with the spacing of the lines, by means of the points, ratchet wheels, brace, and its projecting piece, so that the belt may run in one continuous direction, whilst the paper carriage may be traversed back and forth."

116. For an *Improvement in Annealing Furnace;* J. Joseph Eagleton, City of N. Y.

*Claim.*—"Charging and discharging an annealing furnace in bulk."

117. For an *Improved Method of Operating Saw-Mill Blocks;* Bela Gardner, Florence, Massachusetts.

*Claim.*—"Operating or adjusting the blocks of saw-mill carriages by means of the screw, endless chain, and shaft, in combination with the pinions and clutches."

118. For an *Oracular Wheel or Centre Table;* William O. George, Richmond, Virginia.

*Claim.*—"The said table, called the oracular wheel, or unique centre table, in combination with the game of equality, together with the checks. Also, in regard to these their application to this particular way, and for the particular purpose, and the method or arrangement of them, in combination with the table and game, by which particular effects are produced, or certain results arrived at."

119. For an *Improvement in Artificial Decoloring Compounds;* Francis Gerau, City of New York.

*Claim.*—"The use of phosphate of lime, precipitated out of a solution in muriatic acid, as an ingredient in a compound of materials, for the manufacture of a decolorating coal, which other materials may be varied, according to circumstances."

120. For an *Improved Swing Bolt for Fastening Shutters;* John Gunner, Jr., City of New York.

*Claim.*—"The use of the bolt, lever, and hub, operating in connexion with the catch plate, when the same is cast with a channel."

121. For an *Improvement in Gas Retort Fastening;* John G. Hock, Newark, N. J.

*Claim.*—"The attachment of the bail to the retort, or other mouth, by means of the hook headed bolts."

122. For an *Improved Shingle Machine;* Edward Hedley, Shelby, New York.

*Claim.*—"The formation of the endless feeding bed of beveled slots, so as to give the required taper to the shingle, as it passes beneath the knives of the revolving cams."

123. For an *Improved Horse Shoe;* John Henderson, Elmira, New York.

*Claim.*—"Arranging a special bearing surface, adapted to the rim of the hoof, and terminating in lines converging from the outer to the inner edge of the shoe upon the bars, with a gradual reflection of the heel, beginning at the converging lines, and extending to the near parts of the shoe."

124. For an *Improvement in Telegraphs;* David E. Hughes, Louisville, Kentucky.

*Claim.*—"1st, The holding in place of the attractive power of electro or natural magnetism, as applied to telegraphic purposes. 2d, Combining with a permanent magnet an adjustable spring, almost sufficient to sever it from its contact with the soft iron of the electro-magnet, and a lever, or its equivalent, which, after the permanent magnet has been separated from the iron by the action of a current, shall bring it back again into renewed contact, by the action of the power which has been called into action by the retreat of the magnet. 3d, The employment of two cog wheels or circuit breakers at

each station, so arranged, that one shall be in connexion with the electro-magnet at the same station, and the other, in connexion with the transmitting cylinder at that station, the whole being arranged so that the connexion alternates at each station, for every letter between the electro-magnet and the transmitting cylinder at that station, in such manner, that the thorough connexion is always simultaneously through the transmitting cylinder of one station and the electro-magnet of the other station, whereby the machine at each station can at the same time be transmitting a message and receiving a message. 4th, So arranging a bolt and operating the same, by a cam or its equivalent, that it shall act upon a wheel attached to the shaft of the type wheel, so as to preclude the intelligence from one station being communicated to any other station or stations on the circuit on which it is desired to withhold the communication. 5th, The employment of a vibrating spring, properly weighted at its extremity, if necessary, and so arranged by a series of mechanism as to govern and regulate the movement of the type wheel. This, I claim, also, as a governor in other machinery, without limiting its use to its connexion with electro magnetism. 6th, Printing by electro-magnetism, by a continuously moving type wheel, printing while in motion. 7th, The arrangement of a cylinder with pins spirally arranged thereon, to operate by contact with metallic points to close and break the circuit, when this combined with the systems of keys and catches, so arranged, that any desired point may be thrown into a position where it will be retained until it is struck by its corresponding pin."

125. For an *Improved Method of Regulating Wind-Mills;* Morgan S. Johnson, Palatine, Illinois.

*Claim.*—"The particular mechanical devices, so arranged for the purpose of housing the sails."

126. For an *Improved Printing Machine;* John M. Jones, Palmyra, New York.

*Claim.*—"The manner of attaching the lever to the wheel, so that the same may turn said wheel, while its fulcrum rests upon a fixed plate, situated below the revolving wheel, allowing at the same time, a revolving motion and a motion in the direction of its axis to the wheel, said lever being connected with the mechanism, by the rod passing through the hollow shaft of the wheel. Also, The arrangement and use of the lever, for the purpose of pressing down the type on the paper, when an impression is to be made, and at the same time insure always the right position of the type and wheel. Also, the swinging wheel attached to a hollow shaft, having projections on its periphery, corresponding in number and thickness to the type, for the purpose of moving the carriage with the paper attached, the exact distance necessary for printing one letter after the other."

127. For an *Improvement in Feathering Paddle Wheels;* Harvey Lull, Hoboken, New Jersey.

*Claim.*—"Imparting to the paddles of paddle wheels, a rotary motion on their axis, whilst revolving about the axis of the paddle wheel, by means of an eccentric cog wheel, combined with and engaging the cogs of the pinions on the shaft of the paddles, the form of which pinions is generated."

128. For an *Improved Water Metre;* Nathan B. Marsh, Cincinnati, Ohio.

*Claim.*—"1st, The manner of pinching the diaphragm between the plates, so as to perfectly and at all times pack the joint between the chambers which it divides, viz: by means of the projecting flanches on each lapping past each other, and the nuts to hold them together. 2d, The double reversing valve movement, namely, the two solid cylindrical valves, having their spindles connected by a rocking beam, playing within tubes, communicating at their ends with the supply and discharge, respectively, and with the respective compartments of the measuring cylinder, by means of apertures in their sides."

129. For an *Improved Hydraulic Engine;* Augustin Miller, Grafton, Virginia.

*Claim.*—"The combination of the cut-off motion with the relief pipes, for the purpose of cutting off the stroke at any desired stage, without being compelled to waste the power, by working the piston against atmospheric pressure."

130. For an *Improvement in Surface Condensers for Steam Engines;* James M. Miller, City of New York.

*Claim.*—"Passing the water of condensation in or upon the main body of the condensing surfaces, on its way to the boiler, under the pressure of the steam and the cold external water on the other portion of the surface."

131. For an *Improvement in the Construction of Gas Generators;* Max Pettenkofer and Charles Ruland, Munich, Bavaria; patented in Bavaria, Feb. 24, 1851.

*Claim.*—"The construction and arrangement of the many chambered regenerators, for making gas from wood or vegetable fibre, whereby the primitive vapors of destructive distillation of wood or vegetable fibre, are progressively treated up beyond the heat in the retort."

132. For an *Improvement in Devices for Setting Artificial Teeth;* William G. Oliver and Thomas Harrison, Buffalo, New York.

*Claim.*—"Making the teeth with grooves in their cheeks, and attaching them to the plate by fusible metal cast into said grooves. Also, making the plate, and attaching the teeth at one operation by casting."

133. For an *Improved Elevator for Cotton, Sugar Cane, &c.;* E. Price, Waterproof, Louisiana.

*Claim.*—"The arrangement of the table with the carrier apparatus."

134. For an *Improved Floating Drawbridge;* Napoleon B. Proctor, Burlington, Vt.

*Claim.*—"The construction of a floating drawbridge, by erecting a wharf or dock, on each side of or partly or wholly within rivers or other waters, over or across which such bridge may be required, with a slip in one of said docks or wharves, of a suitable size for the reception of a boat of proper dimensions, viz: nearly as wide as the slip, and about twice the length of the open space between the docks or wharves, (through which open space vessels may pass and repass,) which boat, by steam or other power, can be readily worked forward to the opposite dock or wharf, and thus form a connexion therewith, and back again into the slip, leaving the space or channel open for the passage and repassage of vessels."

135. For an *Improved Method of Hanging Reciprocating Saws;* John Robingson, New Brighton, Pennsylvania.

*Claim.*—"Attaching the upper end of the saw to the pendent or arm, which is connected to the upper frame, and the lower end of the saw to the pitman, just above the point of connexion of said pitman with the lower frame."

136. For an *Improved Carriage Shaft Coupling;* James D. Sauren, Columbia, Tenn.

*Claim.*—"The employment upon couplings for carriage shafts or tongues, which consists in enlarging the journal of the shaft iron in the centre, so as to form a globular ellipsoidal or double conical bearing surface, and clamping the same between the clip irons, countersunk, by means of screws or other equivalent devices, so that the wear is entirely upon the enlarged surface, and all lateral play and rattling of the clip irons are prevented. Also, in combination therewith, the leather packing, for the purpose of retaining the lubricating material."

137. For an *Improvement in Surface Condensers for Steam Engines;* Nathan Thompson, Jr., Williamsburgh, New York.

*Claim.*—"1st, An elastic junction of a tube with a tube sheet, composed of a thimble on a tube sheet, and a short piece of elastic tubing applied thereto, and to a tube end or a collar on a set of tubes. 2d, Uniting firmly several small tubes into a collar, which latter is attached to a tube sheet, by means of a slip or elastic joint, whereby several tubes require only a single stuffing box or elastic junction, in order to compensate for their expansion and contraction. 3d, In conjunction with an elastic junction, metallic clamping rings, or their equivalents."

138. For an *Improvement in Excavating Scoops;* John Taggart, Roxbury, Mass.

*Claim.*—Applying one or two discharges within a pair of scoops, so as to operate therewith or to be operated thereby."

139. For an *Improvement in Lining Metal Pipes with Gutta-Percha;* A. D. Puffer, Somerville, Mass.

*Claim.*—"The methed of lining metallic pipes with gutta-percha, the pipe being drawn down upon the lining."

140. For an *Improvement in Ash Leaching Apparatus;* Philip Perdew and Alexander Brinkerhoff, Sycamore, Ohio.

*Claim.*—"The mechanical arrangement and combination of the metallic pen and reservoir with the tube and the wooden screen."

141. For an *Improvement in Gas Retort Cleaners;* Samuel H. and Matthew C. Walker, Lancaster, Pennsylvania.

*Claim.*—"Providing the retort with a receptacle below its bottom, and applying in connexion therewith a scraper, to scrape the residuum from the bottom of the retort into the said receptacle, without suspending the operation of the retort."

142. For an *Improved Music Rack;* Thomas Ward, Birmingham, Pennsylvania.

*Claim.*—"The jointed or adjustable bar, the bar provided with the blade, and attached to the sliding bars by the sliding springs, the bar having a plate attached to it provided with a spring—the above parts being fitted in a frame, which is allowed to fold or be turned in a vertical or horizontal position."

143. For an *Improved Saw Set;* Edward S. Watson, Chenango Falls, New York.

*Claim.*—"The arrangement of the side set screw, and the bed for the saw plate, and the central adjusting screw, for giving to the bed and the saw blade the inclined position, and thus allowing the tooth of the saw to have given to it the curved or twisted face."

144. For an *Improved Mode of Extracting Stumps;* George W. Zeigler, Tiffin, and Manasseh Grover, Sandusky, Ohio.

*Claim.*—"Utilizing the weight of tree while falling, for extracting its stump, by the combination of chains and hooks, and adjuster."

145. For an *Improvement in Working in Sheet Metal;* J. B. Holmes, Cincinnati, O.

*Claim.*—"The use of corrugated plates, operating in connexion with the eccentric bending and gauging shafts."

146. For an *Improved Weighing Cart;* James W. Martin, Assignor to Lewis Rotherwell and James Martin, Burlington, New Jersey.

*Claim.*—"The levers, constructed with the scale beam, in combination with the bar."

147. For an *Improvement in Ventilating Registers and Dampers for Stoves;* John Magee, Lawrence, Assignor to self and William J. Towne, Newton, Mass.

*Claim.*—"Combining with or arranging in the flue pipe, when the flue is constructed, (viz: with two discharge pipes,) a rectangular box or chamber formed with an opening, and so as to receive within it and permit to operate, a rectangular valve and damper."

148. For an *Improvement in Machinery for Making Rope and Cordage;* William R. Butcher, Assignor (by intermediate transfer) to Harvey Church, Troy, N. York.

*Claim.*—"1st, The arrangement of the gear wheels, pinions, plate, and ring, for sustaining and revolving the creel shafts. 2d, The adjustable friction wire or cord, passing around in the disks of the circular ranges of bobbins, thereby simultaneously regulating all the yarns in each range to precisely the same tension. 3d, The adjustable tube over the centre of the lay-up block, for the purpose of regulating, by its proximity to said lay-up block, the tension of the various yarns composing the strands. 4th, The construction of the lay-up cap on the end of the shaft fitted to receive the movable cone and adjustable tube, so that the tube and cone can be conveniently changed, to adapt the parts to laying-up different sized rope or cordage. 5th, Leading the yarn off from the bobbins, to a hole or guide on the arms, or their equivalents ,on the opposite side, or nearly so, of the circular ranges of bobbins in the creel."

149. For an *Improved Lathe Attachment for Turning Irregular Forms;* Milton Roberts, Assignor to self, Isaac Roberts, and Isaac N. Felch, Belfast, Maine.

*Claim.*—"Automatic lathe attachment for turning figured wood work, substantially a transverse and longitudinal movement, produced by cranks and inclined planes, or their equivalents."

150. For an *Improvement in Locomotive and Railroad Lamps;* John Stuber, Assignor to John Carton, Utica, New York.

*Claim.*—"The tubed structure as combined with the burner, to regulate the flow of air to the exterior of the flame of the lamp. Also, the arrangement of the feeding cup and the tube, provided with the regulating spirally grooved fillet."

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151. For an *Improved Method of Operating Head Blocks of Saw Mills;* Lucius B. Adams, Smithfield, Pennsylvania.

*Claim.*—"The lever, with pawl attached, and lever or arm, having a roller at its

lower end, and the incline attached to the flooring, and operating in connexion with the ratchet, pinion, and racks."

152. For an *Improvement in Operating Steam Stamps;* William Ball, Chicopee, Massachusetts.

*Claim.*—"Stopping the operation of the stamps, whenever the piston is allowed to descend to a certain point, by the neglect to feed the material to the mortar in time."

153. For an *Improved Car Window;* James Butler, New Bedford, Mass.

*Claim.*—"Combining with the movable window frame and its socket frame or opening, four bolts and four sets of socket holes or bars provided with such holes—the whole being arranged so as to operate together. Also, combining with the window frame and its socket frame or opening, made in the side of the carriage, two sets of hinged arms, applied to opposite sides of the frame."

154. For an *Improvement in Photographic Pictures on Glass;* Albert Bisbee, Columbus, Ohio, and Y. Day, Nashville, Tennessee.

*Claim.*—"Making the border of the picture transparent, and placing the mat back of the picture."

155. For an *Improvement in Brick Machines;* Martin and James H. Buck and Francis A. Cushman, Lebanon, New Hampshire.

*Claim.*—"Connecting the plunger with the block or mould clearer, by means of the rods, having the racks on their lower parts, which racks gear into the part pinions on the shaft, whereby the plunger is allowed to rise more rapidly than the mould clearers."

156. For an *Improvmeent in Attachments for Piano Legs;* William Clark, City of New York.

*Claim.*—"Securing the metallic connexions for attaching legs to pianos, or other articles, into the respective parts of the leg and bed, by means of diagonal dowels, taking recesses in the sides of said metallic connexions."

157. For an *Improvement in Breech Loading Fire Arms;* Nathan S. Clement, Worcester, Massachusetts.

*Claim.*—"Rubber packing, or that material which is substantially the same, in connexion with breech loading fire arms."

158. For an *Improvement in Grinding Circular Saws;* William Clemson, East Woburn, Massachusetts.

*Claim.*—"1st, The combination of the roll with the grindstone. 2d, The use of the flat pivot, for the purpose of enabling the stone to operate upon the entire surface of the saw."

159. For an *Improvement in Boot Trees;* Charles T. Eames, Milford, Mass.

*Claim.*—"The arrangement or mode of applying a simple cam and inclined plane, with respect to the foot and leg portions of the boot-tree, whereby the said devices are made to first perform the function of setting the foot parts of the tree firmly into the foot of the boot; and, next, that of stretching the leg of the boot, the application of stretching mechanism directly to the upper part of the leg of the tree being rendered unnecessary."

160. For an *Improved Mode of Constructing Portable Houses;* Daniel Fitzgerald, City of New York."

*Claim.*—"1st, The constructing houses of staves, held together by hoops. 2d, Combining the staves in segments or parts of the periphery, some of which shall combine the doors and windows, to facilitate the putting up and taking down. 3d, Constructing the floors in segments. 4th, Sustaining the thrust of the roof by a hoop, which also confines the staves."

161. For an *Improvement in Securing Nuts to Carriage Axles;* Kingston Goddard, Philadelphia, Pennsylvania.

*Claim.*—"The method of securing screw nuts on axles, by combining with the nut a spring friction brake, to act on the thread of the screw by the tension of the spring—the lever or arm of the said brake, being made to extend beyond one of the faces of the nut, that the brake may be withdrawn from the thread of the screw, by the act of putting on the screw-wrench, to take off or put on the nut."

162. For an *Improved Engine Governor for Side-wheel Ocean Steamers;* Wm. B. Godfrey, Auburn, Iowa.

*Claim.*—"The employment in connexion with a propelling paddle-wheel, of a second paddle, which herein turned the governing wheel, fitted loosely to the same shaft, and having applied to it springs to control its position, relatively to the propelling wheel, when the wheel is out of the water, or not in motion; and being connected with a lever, or its equivalent, which works on a fulcrum, secured to the propelling wheel, and which is connected with the throttle valve or cut-off in such a manner, that when the propelling wheel is out of water, or not in motion, the governor wheel will close the throttle valve or cut-off—but when it is in operation in the water, the resistance of the water to the paddles of the governor wheel, will cause the said wheel to move relatively to the paddle-wheel, and by that means, give the throttle valve or cut-off more or less opening."

163. For an *Improvement in Reed Musical Instruments;* Emmons Hamlin, Assignor to self, and Henry Mason, Boston, Mass.

*Claim.*—"The construction of a rigid or non-elastic wind chest with the ordinary expanding wind chest connected together. Also, the peculiar construction and arrangement of the coupler, consisting essentially of the tongue interposed between the lever and the key."

164. For an *Improvement in Cases for Sewing Machines;* William O. Grover, Boston, Massachusetts.

*Claim.*—"Arranging a box or case for a sewing machine, so that when open, the box shall constitute the bed for the machine to be operated upon; and hanging the machine thereto, to facilitate oiling, cleansing, and repairs, without removing it from the box, and the peculiar adaptation of the handle, so that it may be pushed out when required to drive the machine, and when returned within the box, shall serve to prevent motion of the parts, whilst the machine is being transported."

165. For an *Improved Guard for Circular Saws;* Henry Gross, Tiffin, Ohio.

*Claim.*—"The mechanical construction and arrangement of the circular saw guard, to wit: The whole, in combination, as a useful and novel invention, to protect the workman from injury while working the saw, thereby keeping his hands and person away from the saw teeth, and also preventing injury to him, by keeping down the ends of the plank or stick, while the saw is passing through it."

166. For an *Improved Lock and Key;* Ezekiel M. Hendrickson, Brooklyn, N. Y.

*Claim.*—"1st, The construction and use of the key, which spontaneously projects slender arms through a revolving cylinder, for the purpose of simultaneously detaching catches from the bolts. 2d, The combination of the key, or the mechanical equivalent thereof, with the revolving cylinder, the check levers, the locking lever, and the springs."

167. For an *Improvement in Floats for Steam Boilers;* F. A. Hoyt, Boston, Mass.

*Claim.*—"Charging the float with compressed air."

168. For an *Improvement in Machines for Sizing Hat Bodies;* Samuel C. Ketchum, Brooklyn, New York.

*Claim.*—"The use of the combination of the elastic shell (upon the revolving drum or cylinder), with the vibratory rubber case surrounding the same."

169. For an *Improvement in Mowing Machines;* William F. Ketchum, Buffalo, New York.

*Claim.*—"Attaching, any where between the shoes, to the back part of the cutter bar of a mowing machine, an adjustable and jointed lever, either with or without a wheel."

170. For an *Improved Arrangement of Means for Operating the Valves of Steam Engines;* Charles K. Landis, Philadelphia, Pennsylvania.

*Claim.*—"The combined mechanism of the float, slide valve, and double valve."

171. For an *Improvement in Safety Valves for Steam Engines;* Alexander B. Latta, Cincinnati, Ohio.

*Claim.*—"The mechanical means, or any equivalent arrangement."

172. For an *Improvement in Cotton Gins;* Wm. B. Lindsay, New Orleans, La.

*Claim.*—"The combination of the reciprocating cards, vibrating stripping cards, and ribs."

173. For an *Improved Excavator;* Charles A. Mann, Jr., Pike, New York.

*Claim.*—"The construction and arrangement of the cylindrical chambers, formed with the inscribed semi-rotating arms, the scoops, the fingers, and friction disks, with the combination therewith of the springs; the whole operated through the obliquely arranged wheels, in combination with the bowed cam plates. Also, the arrangement of said devices, in combination with the adjustable or graduating framing, and the plough attachment."

174. For an *Improvement in Instantaneous Governors for Steam Engines;* Wm. W. H. Mead, Chestertown, New York.

*Claim.*—"Combining the fly governor with the throttle valve, by fitting it loosely to the spindle, and driving it by friction from the wheel, which is loose on the same spindle, and which derives its motion from the said spindle through a spring, the said wheel being connected in any convenient manner with the throttle valve or cut-off, so that it may be caused by the retarding or advancing effect of the moment of inertia of the governor or fly, as the speed of the engine is suddenly increased or diminished, as to diminish or increase the supply of steam to the engine."

175. For an *Improved Tool for Boring Hubs;* H. L. Mooney and W. B. Carter, Astoria, Illinois.

*Claim.*—"The construction of the tool, with the excavating and shouldering cutters, in separate slide bars, capable of a simultaneous outward movement, and relatively so situated, that the shouldering cutter is made to perform the double function of cutting the shoulder, and holding the tool firmly upon the hub."

176. For an *Improvement in Winding Thread from Skeins;* Marcus Ormsbee, Roxbury, Massachusetts.

*Claim.*—"The arrangement of the hooks, the spools, and the elastic strap."

177. For an *Improved Billiard Que;* Conrad Leicht, City of New York.

*Claim.*—"The mode of providing said cue top, with screws, and adjusting them to the cues."

178. For *Musical Notation;* Philetus Phillips, Middletown Point, New Jersey.

*Claim.*—"The use of a line of a distinct character, on which to write each elementary note, and the transposing of such lines, to effect and denote the different transpositions of the scale."

179. For an *Improvement in Looms;* Robert Pilson and Stephen P. Heath, Laurel, Massachusetts.

*Claim.*—"The combination of a balance catch in the shuttle, in combination with the balance weight in the lathe, acting from gravity."

180. For an *Improvement in Apparatus for Cleaning Gutta-percha;* James Reynolds, City of New York.

*Claim.*—"The extraction of the bark and foreign substances from gutta-percha, by cutting the blocks of the raw material into extremely thin slices or sheets, and submitting the said slices or sheets to a beating or rubbing and screening operation."

181. For an *Improvement in Hand Propellers;* John G. Ross, City of New York.

*Claim.*—"The plate and lance points, in connexion with the propelling bucket."

182. For an *Improvement in Self-sealing Preserve Vessels;* William J. Stevenson, City of New York.

*Claim.*—"In combination with the mouth of the vessel, constructed with a shoulder, at some distance from its entrance, and the packing ring resting on the said shoulder, I claim the cap, made with its bearing part smaller than the exterior of the ring, and with raised guide pieces, which keep it in place in the mouth, so as to cause it to set an equal width of bearing all round the ring, but do not prevent the necessary imbedding of the edge of the bearing part of the cap in the packing."

183. For an *Improvement in Rotary Knitting Machines;* Clark Tompkins and John Johnson, Troy, New York.

*Claim.*—"The combination of the tension roller with the take-up mechanism, or its equivalent, when applied to rotary knitting machines."

184. For an *Improvement in Making Steel;* Franz Uchatius, Vienna, Austria; patented in Austria, March 14, 1855.

*Claim.*—"The conversion of pig iron into steel, by subjecting the same, when reduced to a granulated state, to the combined action of oxidizing agents, and the requisite fluxes, whereby I am enabled to manufacture cast steel, of determinate quality, and obtain it at one melting."

185. For an *Improved Shingle Machine;* Henry White, Oneida Castle, N. Y.

*Claim.*—"The plates, so arranged as to bring the butt of the shingle into the centre between the knives, and hold it there while it is being shaved. Also, the spring forceps, so arranged as to seize and remove the shingle after it is shaved."

186. For an *Improved Valve Gear for Steam Engines;* Herman Winter, City of N. Y.

*Claim.*—"1st, An eccentric on the main shaft, a lever properly governed and connected therewith, and a crank upon a secondary shaft—the whole in combination and connected each to each. 2d, An eccentric, or its equivalent, upon a revolving shaft, in combination with a rod or lever connected therewith, receiving a reciprocating motion from the eccentric, and a vibrating motion, whereby valves of steam engines may be raised and lowered. 3d, Forcing rods or levers, caused to reciprocate, to vibrate in the plane of their reciprocation, by a positive motion derived from some convenient part of the engine, through the intervention of bell cranks, radius bars, and links, or their equivalents. 4th, Changing the centre of vibration of reciprocating vibrating levers, or altering the distance through which they vibrate, in combination with a toe or foot, curved, whereby the period of cut-off may be varied. And, lastly, altering the position of the pivots of a bell crank, provided with a link and radius bar, whereby the period of cut-off may be varied at the pleasure of the attendant."

187. For an *Improved Method of Securing Plane Bits;* Thomas D. Worrall, Boston, Massachusetts.

*Claim.*—"The arrangement of the clamp and the screw rod, with respect to the plane cutter and its stock."

188. For an *Improvement in Grain and Grass Harvesters;* James T. Youart, Troy, New York.

*Claim.*—"The cutting device, formed of the reciprocating frame, with the straight edged sickle attached, in combination with the square edged collectors, connected with the frame, and having a vibrating movement."

189. For an *Improvement in Replaceable Axle Box for Railroad Cars;* William D. Arnett, Cincinnati, Ohio.

*Claim.*—"The arrangement by which the entire case can be removed, with the enclosed oil box and bearings; said box or case being slid into place, and attached to the piece upon which the spring rests, by means of the lugs and recess."

190. For an *Improved Method of Drawing Fluids from Bottles;* J. Willard Fox, Durhamville, New York.

*Claim.*—"Packing the plugs of faucets, with india rubber, gutta-percha, leather, or some other similar substances, when the same piece which packs the plug is made to pack the end of the bottle nose, pipe, tube, or other article to which the faucet is applied."

191. For an *Improvement in Ships' Capstans;* Samuel Gaty, St. Louis, Missouri.

*Claim.*—"The arrangement of the ratchets and pawls, and spur wheels and pinions, in capstans or windlasses, so that simply reversing the prime mover, will change it from a simple to a compound capstan, without shifting any of the parts by hand, and so that also the spur wheels and pinions may only rotate when used as a compound capstan, and be self-ungearing when changed to a simple one."

192. For an *Improvement in Calipers for Measuring Irregular Forms;* Elliot T. Miller, Charlestown, Massachusetts.

*Claim.*—"The calipers, consisting essentially of the fingers, plates, and elastic blocks."

193. For an *Improved Coupling for Vehicles;* Henry Miner and Henry M. Stevens, City of New York, and Wm. H. Saunders, Hastings, N. Y.

*Claim.*—"A ring of vulcanized rubber, or some other yielding and more or less elastic material, applied in combination with a divided eye, and a bolt or pin in the clips, either immovably or in such manner that it can be taken out and replaced—the whole being applied to vehicles."

194. For an *Improvement in Ships' Capstans;* Daniel and George Tallcot, Oswego, New York.

*Claim.*—"The gears arranged at the top of the capstan, in combination with the shaft, and gears arranged at the bottom of the capstan, for communicating a slow and powerful motion to the barrel."

195. For an *Improved Machine for Manufacturing Felloes;* A. B. Richmond, Meadville, Pennsylvania.

*Claim.*—"1st, The saws, constructed so that they may be adjusted at any required circle, by means of the set screws, and also constructad with the saw hands and fingers, and slots and set screws combined. 2d, The contrivance and construction of platform, with the combination of gauges and set screws, for cutting the felloe the proper length. 3d, The combination by which the bits for the spokes and dowel pins are made to move towards the felloe, at the same time, or different times, as may be desired."

196. For an *Improvement in Self-acting Mules;* Wm. W. Weir, Chicopee, and Wm. Grover, Holyoke, Massachusetts.

*Claim.*—"The application to mules, of the faller, denominated a third faller, operated by the mechanism or the equivalent thereof, when used in combination with a faller, and counter faller. Also, the combination and arrangement of the levers and latch."

197. For an *Improvement in Ploughs;* George W. Zeigler, Tiffin City, Ohio.

*Claim.*—"Simply an improvement upon the invention of Norton; that is to say, combining with land side and mould board, a cutter, jointed to the land side, and movable between land side and mould board, independent of the mould board and share."

198. For an *Improvement in Corn Shellers;* Charles S. C. Crane, Assignor to Samuel M. Tinkham, Taunton, Mass.

*Claim.*—"The shelling wheel, toothed or corrugated on both sides, the pressure bars, provided with plates on their upper ends, and the feeding device, composed of the uprights and the board."

199. For an *Improvement in Valves in Steam Engines;* John F. Allen, City of New York, Assignor to Noah L. Cole, Norwich, Conn.

*Claim.*—"The movable valve seat, arranged and operating between the valve and the usual valve seat."

200. For an *Improvement in Parlor Organs;* Thomas Sands, Chelsea, Assignor to self, and John P. Lindsay, Roxbury, Massachusetts.

*Claim.*—"Arranging the pipes horizontally in compact tiers, one above the other, when each succeeding tier is placed at a greater distance from the wind chest than the one below it, for the accommodation of the mouths of the pipes—all the pipes, except those of the lower tier, being connected with the wind chest, by means of the conductors. 2d, The peculiar combination and arrangement of the action with the short keys; that is to say, the combination of the keys, the levers, the stickers, and the jacks. 3d, The coupler rods, with their bent wires, in combination with the stickers, and the auxiliary stickers, for the purpose of coupling the notes with their actions. 4th, The method of holding the metallic pipes in place, by means of the bar, the rod, and the spring."

### Additional Improvements.

1. For an *Improved Faucet;* Moses Woodbury, Boston, Mass.; patented March 11, 1856; additional May 6, 1856.

*Claim.*—"The combination of the screw, or its mechanical equivalent, with a hollow cylinder-valve, and the spring, when the latter is placed behind the valve."

2. For an *Improvement in Means for Holding Window Blinds;* Henry A. Frost, Worcester, Mass.; patented January 23, 1855; additional May 6, 1856.

*Claim.*—"The improved manner of hanging the brace, so that it will operate freely, by its own weight, and casting or swedging the notches, or their equivalent, so as to retain the blind in any desirable position."

3. For an *Improved Coupling for Carriages;* Abram J. Gibson, Clinton, Massachusetts; patented Sept. 12, 1854: additional May, 27, 1856.

*Claim.*—"Arranging above the threaded bolt, and with respect to the guard from

which it extends, a seat or connexion, for the spring or other part of a carriage. Also, arranging in the threaded bolt, and so as to pass up through it and its rest, a socket or passage for the reception of a screw bolt, serving not only to confine a spring or bar down upon the seat, but for the specific purpose of preventing accident, in case of breakage of the threaded bolt at its neck."

RE-ISSUES FOR MAY, 1856.

1. For a *Preparation of Oil Ground to receive Photographic Impressions;* Joel H. Tatum, Baltimore, Maryland; patented April 15, 1856; re-issued May 13, 1856.

*Claim.*—"The mode of preparing and rendering oil (or oleaginous) bodies, grounds, or surfaces, impressible or sensitive to the photographic art, by the temporary destruction or chemical change of the oil, or oleaginous matter, on the immediate surface only, by the use of spirits of wine and alkaline solution, or their equivalents, and after fixing the impression, by the use of hypo-sulphate of soda, the use of dilute acid, by which last application, the alkalies are neutralized, and the oil restored, with the impression permanent upon the surface."

2. For an *Improvement in Machines for Planking Hat Bodies;* Albert Spencer and Alve E. Laing, Assignees of Phineas Emmons, City of New York; patented April 19, 1853; re-issued May 27, 1856.

*Claim.*—"The use of an endless table, or band, having a differential or vibratory forward revolving motion, in combination with a rubber or presser, whereby a forward, vibratory, rolling, and pressing motion is given to the *roll* of hat bodies, or felt, for sizing it up, and at the same time, carrying it through the machine."

DESIGNS FOR MAY, 1856.

1. For *Piano-Forte Legs;* Isaac Engel, Boston, Mass.; May 13, 1856.

*Claim.*—"The ornamental design."

2. For *Cooking Stoves;* Anthony J. Gallagher, Philadelphia, Pennsylvania.

*Claim.*—"The arrangement and combination of the ornaments."

3. For *Parlor Stoves;* N. S. Vedder and Wm. L. Sanderson, Assignors to N. S. Vedder, Troy, New York; May 13, 1856.

*Claim.*—"The ornamental design and configuration."

4. For *Plates of Cooking Stoves;* W. L. Sanderson and N. S. Vedder, Assignors to Sanders, Wolfe & Warren, Troy, New York; May 13, 1856.

*Claim.*—"The ornamental design and configuration."

5. For *Oven and Stove Doors;* Joseph A. Reed, Assignor to John H. Cahill, Philadelphia, Pennsylvania; May 13, 1856.

*Claim.*—"The figures."

6. For *Stoves;* Samuel W. Gibbs, Assignor to W. and J. Treadwell, Perry, & Norton, Albany, New York; May 20, 1856.

*Claim.*—"The combination and arrangement of ornamental figures, &c."

7. For *Parlor Stoves;* David Hathaway, Assignor to Cox, Richardson, & Boynton, Troy, New York; May 20, 1856.

*Claim.*—"The ornamental configuration of plates."

8. For *Cooking Stoves;* Thomas A. Herrick, East Bridgewater, Assignor to Samuel M. Leonard, Taunton, Massachusetts; May 20, 1856.

*Claim.*—"The ornamental design of the doors and side plate."

9. For *Combined Match Safes, Paper Weights, and Pin Cushions;* Michael B. Dyott, Philadelphia, Pennsylvania; May 27, 1856.

*Claim.*—"The new design."

10. For *Portable Ranges;* James Horton and John Currie, Assignors to Cox, Hager & Cox, Philadelphia, Pennsylvania.

*Claim.*—"The designs, &c., of the ornaments in bas-relief, and mouldings."

11. For *Piano-Forte Legs;* Albert Bosworth, Assignor to self, and Timothy H. Loomis, Westfield, Massachusetts; May 27, 1856.

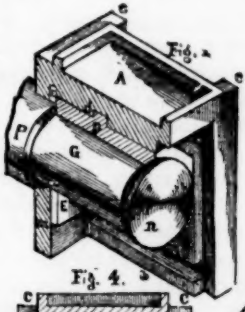
*Claim.*—"The form, &c., of the central fluted column, and the pendant or jutting device."

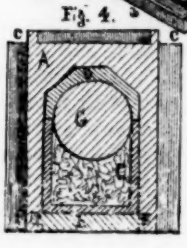
## MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

*Description of D. R. Perkinpine's Patent Axle Box, for Locomotives and Railway Cars.* By H. Howson, Civ. Eng.

This invention, for which a patent has been recently granted, and which has been already alluded to in this Journal, [page 359, Vol. xxi,] consists in constructing and arranging the axle boxes of locomotives and cars, in such a manner, that the outside end and bottom, (which is cast in one piece separate from the other portions of the box,) may be easily removed and replaced at pleasure, and with it a reservoir for the oil and cotton, which reservoir is likewise a separate and distinct casting; the object being in order that the axle bearing and journal may be easily examined, and the reservoir cleansed and replenished with lubricating matter, with greater ease and facility than the same can be accomplished in other axle boxes.





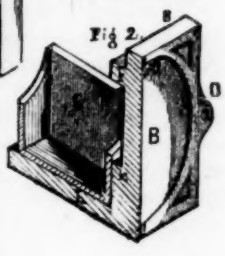




Fig. 1, is a sectional perspective view of half the box.

Fig. 2, a perspective view of half the movable front and bottom, showing the oil reservoir.

Fig. 3, an end view of the box.

And Fig. 4, a transverse section of the same.

A, is the shell of the box, having flanches *c c*, which act as retaining pieces, when placed in the hanger of the locomotive or car, in the same manner as ordinary boxes.

On the inside are cast pieces *a a*, shaped at the top in such a manner as to receive the brass step D, which is maintained in its proper position by the projection *d*, fitting into a recess formed in the box.

A groove *e*, divides the piece *a*, from the flanch *b*, and into this groove slides the bottom *h*, of the movable piece B, projections *f*, being arranged on the latter for this purpose.

C, is the reservoir, in which is placed the cotton saturated with oil, or other lubricating matter; this reservoir is arranged at the top to fit pretty accurately to the journal of the axle, and rests on the bottom *h*, of the movable piece B; in front of the latter are two lugs *o o*, through which pass small set screws, serving to confine the movable piece to the body of the box.

On the outside of the piece B, is a recess *k*, of a circular form, to receive the collar *n*, of the axle G. E is a piece of leather, fitting accu-

rately to the enlarged portion *p*, of the axle, and confined between the step D, and back *m*, of the axle box A, in a recess formed for the purpose, thus preventing any escape of the oil in that direction. It will be easily seen without further description, that by simply withdrawing the small set screws, which pass through the lugs *o o*, into the body of the box, the piece B, with the reservoir C, can be readily removed and replaced, affording every facility for examining the journal, and for cleansing and replenishing the reservoir.

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For the Journal of the Franklin Institute.

## *The Steam Frigate Niagara.*

The readers of the *Journal* are, no doubt, aware that this steamer is building under the exclusive direction of Mr. Steers, noted as the builder of the yacht *America*, who has been employed by the Secretary of the Navy for that purpose. Mr. Steers has had his own way, and if he fails in any particular, the fault will be his own. Having recently visited the vessel, I will give you my impressions in relation to her; which, I am sorry to say, are not as favorable as I could wish. She has been designed for great speed, having one-half more power than the other vessels now building, and in taking care of that point, many others of equal or greater value have been overlooked. I have no doubt she will be fast; in fact, I am quite sure of it; but her coal bunker capacity will only be about 12 days' full steaming, if so much. Her capacity for stores is so much below what it should be, that her water tanks are being constructed to fit down to the bilge, filling the space between the kelsons (which it is all essential should be left open and arranged for easy cleaning in warm climates). When the ship was commenced, 100 feet was given up to engines, boilers, and coal bunks, but since her internal capacity has been found so small, seven feet of this space has been taken off, which has reduced the coal capacity to a very low point for her power. On the berth deck the officers' quarters are very roomy, and occupy a large portion of it. While the forward part, devoted to the crew, will (considering the number that occupy it) be found very small. Her gun deck, which is also the spar deck, will no doubt have sufficient room for her small armament of 12 guns. Compared with the other five war steamers, she will have the advantage of speed only, and this is of no advantage in an engagement, (unless it be to run away;) they carry 40 guns, and at each broadside will discharge more than double the weight of shot or shells; they have two tiers of guns, and every shot would be effective in close action, while her guns all being on her upper deck, high above the water, would often fire too high, particularly in close action with a low vessel. To the eye, externally, the *Niagara* is very large, but internally, she is found very small for her tonnage. This deception is owing to her high rail, which deceives the eye looking from without, and having but two decks, while the other vessels have three. Her draft of water will be greater than theirs, so that she can only enter a few of the harbors in the world It has been quite the fashion for some years past to decry our naval steamers, (which are really unsurpassed by any naval steamers of the same

tonnage afloat,) and the editor of one of our Nautical Magazines, has, in his zeal for improvement, often asserted that it was easier to make a war steamer correct in every respect than a private vessel, because in the former, the load was known, while in the latter, it is constantly changing. If he had asserted that to a constructor *knowing* what were the requirements of a war steamer, it would be easier, the remark would have been a true one, but I hold that the building of war vessels is as much a profession as the building of merchant ships, and, although I have a very high respect for our private ship builders who have raised the character of our merchant marine to a point far above that of any other nation, yet I doubt if any of them are fully acquainted with all the requirements of a man-of-war. I am certain that the constructor of the *Niagara* finds many things overlooked, and hence the difficulty of finding room for all she has to carry. I do not wish to be understood as condemning the *Niagara* or fully approving the other ships; both can, no doubt, be improved, and a proper medium between them be found, where capacity will not be sacrificed to speed, and where the number of guns shall exceed three to each 1000 tons measurement. The other five steamers building, are, no doubt, indebted somewhat for their form to the desire of using up the timber frames long on hand at our Navy Yards. With a fresh lot of timber to work from, six inches more head room on the berth deck, and side lights a little less antique, I believe our naval constructors would produce vessels creditable to the navy, if not up to the Young America standard of every thing for speed and nothing for capacity.

FULTON.

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For the Journal of the Franklin Institute.

## *Mechanical Engineering as applied to Farm Implements.*

By H. HOWSON, Civ. Eng.

(Continued from page 406. Vol. XXXI, 3d Series.)

It is curious to observe on looking over the past and present records of the Patent Office, how the attention of the ingenious portion of the community, has been directed at one time to one particular class of subjects; thus, at one period there existed a perfect mania among inventors, in relation to churns, at another period the competition in washing-machines was most intense; then came the era of harvesters, seed planters, sewing-machines, corn and cob mills, &c., &c.

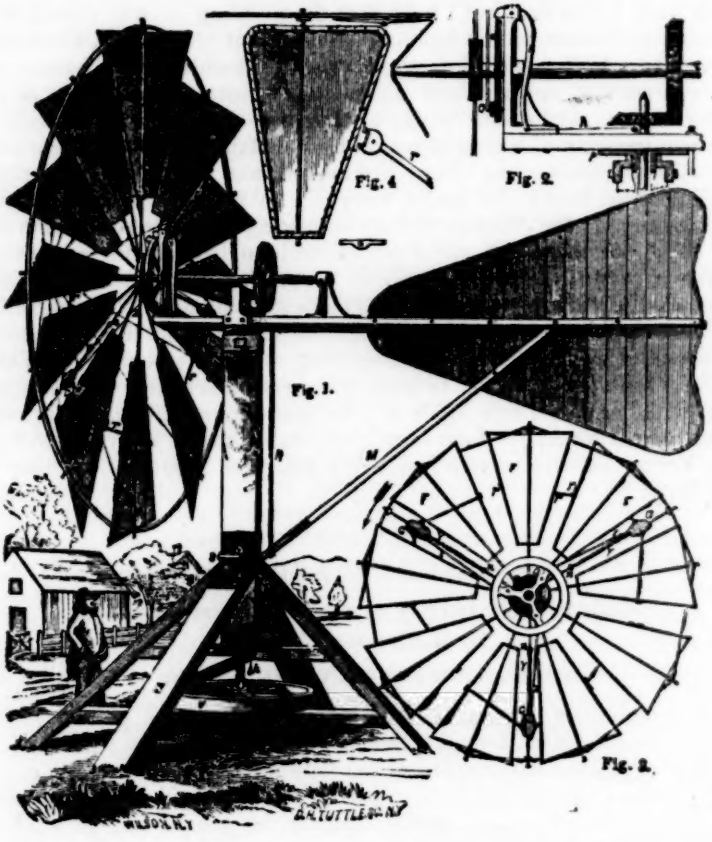
The improvements in wind-mills are now so numerous and varied, and succeed each other so fast, that the present may not inaptly be termed the wind-mill era.

It will not therefore be out of place to record, from time to time, in these papers, some of the many improvements in this class of machinery, improvements which must eventually result in rendering wind-mills a most popular means of obtaining motive power, especially among farmers.

The annexed engraving represents the patent "Self-regulating Wind-mill," of F. G. Johnson, a gentleman who has paid much attention to the subject, and who is the author of an interesting treatise entitled "Wind as a Motive Power."

Fig. 1 is a perspective view, and Figs. 2, 3 and 4 detached sectional views, of Mr. Johnson's improvements.

The main upright beam or stem of the machine is hollow, and rests on and is secured to the cross-pieces, which connect the diagonal stays together, the latter being firmly planted into the ground. To the top of




the stem is secured the socket, in which turns the plate P, the latter being attached to the underside of the swivel beam, on which are secured two brackets which act as bearings for the horizontal shaft, to which is secured a bevel wheel, gearing into a similar wheel on the vertical shaft, which has its upper bearing in the plate, and passing down the interior of the stem, has its lower bearing in the cross-piece which is secured to the diagonal stays, between the latter and the other cross-pieces; it is furnished with a horizontal driving pulley.

The guiding vane, which is secured to the swivel beam, is braced by the rod M, the latter being connected to the ring which turns on the stem near the top of the diagonal stays; this brace, in connexion with the tie rod R, brings the strain of the mill in its tendency to be blown over

on the bottom of the stem, as well as the top; F, F, &c., are the vanes secured to the spindles, which have their bearings at one end in the external ring, and at the other end, and in the hub B, attached to the shafts G, G, are weights arranged to slide on rods *g g*, which extend from the external ring E, to the central hub ; on these rods are regulating nuts *n*, between which and the weights, intervene spiral springs Y. The sliding weights G, are connected by means of rods *r*, to the edges of the vanes, one weight to three vanes. The weights are also connected by means of rods *z*, to pins in the arms of the stop-wheel *c*, which run loose on the shaft. On the top of the front bracket a bent lever I, has its fulcrum; this lever is so arranged, that when required, its point may be made to bear on the periphery of the stop wheel *c*. A cord *h*, is attached to the end of the long arm of the lever, and passes over a pulley and down the stem, at the lower end of which, it is furnished with a weight.

The sliding weights G, figs. 1 and 3, connecting rods *r*, and spiral springs Y, constitute the governor, or regulating apparatus. When the wheel revolves at its maximum velocity, the weights by centrifugal force are thrown out from the centre, and the extremities of the rods *r*, drawn closer together, which causes the vanes to turn edgewise to the wind. The tendency of the vanes is now to revolve slower and slower, until the tension of the springs shall overcome the centrifugal force of the weights, which will slip or draw them in towards the centre again, and thus turn the vanes flat to receive the wind, and give the mill (whenever the wind is sufficiently strong), a uniform velocity, irrespective of the variation of wind, and resistance presented to it. One weight controls three wings by connecting one to another. To give the mill greater or less velocity, it is only necessary to increase or diminish the tension of the springs Y, which is accomplished by turning the nuts *n*, out from, or in towards the centre. To provide against very strong and sudden gusts of wind, the vanes are made wider on the back than on the front side of their bearings, so that they will turn back and crowd the weights out from the centre, before the velocity necessary to do the same could be acquired.

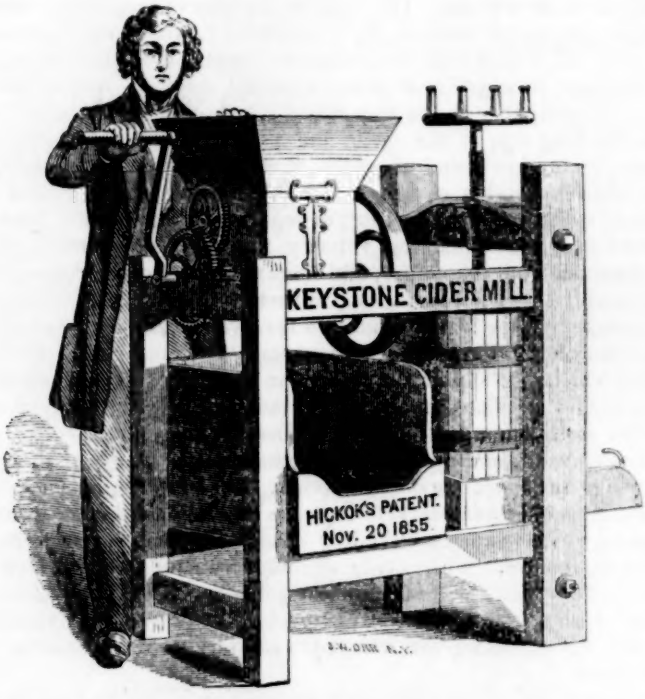
The stop wheel *c*, and the rods *z*, connecting it, and the weights constitute the stopping apparatus, which operates as follows: Thus, supposing brake levers I, (fig. 2,) to be pressing upon the stop wheel, and thus stopping, or rather holding back said wheel, while the main wheel turns on ; then the point O would rise to *o*, or so far above the shaft A, as now it is below it, and thus throw out the weights from G to *g*, and turn all the wings edgewise to the wind, causing them to stand still until the brake is released; the brake is made to operate by means of a weight hung upon a cord *h*. This governor and stopping apparatus it will be seen, revolve with, and constitute a part of the wind-wheel, and are independent of any other part of the mill, thus making the wind-wheel alone self-regulating, and almost self-stopping in spite of any gale.

These mills are sold at prices ranging from $60 to $800, according to size. For the lowest sum a machine is furnished having the power, during a pleasant breeze, of about one man.

### *Hickok's Patent Cider Mill.*

This neat and compact mill will be easily understood from the annexed engravings, without a minute reference to the various parts.

Two operations, the grinding and pressing, are performed on the same frame.




On one end of the latter is secured a hopper, hinged to a box, in the upper part of which is a roller having projections which serve to crush the apples, preparatory to their being acted upon by the two grinding rollers, which consist of iron cylinders, having a number of longitudinal ribs, and crossing these ribs a series of helical strips; in the spaces formed between the ribs and the strips, are projecting teeth. A patent was granted to Mr. Hickok, in November last, for this ingenious arrangement of grinding cylinders, which are so connected by toothed wheels, that one always revolves faster than the other, causing the apples to be rapidly reduced to pomace, which drops into a reservoir below. The shaft of one of the grinding rollers is furnished at one end with a balance wheel, and at the opposite end with a winch, by which the gearing and rollers are set in motion.

On the other end of the frame is secured the pressing apparatus, which consists of a strong screw, arranged to turn in a bracket, secured to two of the uprights of the frame.

The end of this screw is furnished with a disk or piston, fitting the interior of the barrel, which is formed of parallel staves, firmly secured together by means of suitable iron hoops, there being a narrow opening between each stave.

By an arrangement of sieves at the bottom of the barrel, the old fashioned bag is dispensed with, while at the same time the cider is left clear, and the work can be accomplished with much less labor than by the old method.

The above machine is simple, strong, and durable in its construction, efficacious in its results, and moderate in its price, which is but $40; qualities which have rendered it deservedly popular, vast quantities being manufactured at the inventor's establishment in Harrisburg.

Messrs. Landreth, the extensive manufacturers of, and dealers in, agricultural implements, are the agents in this city.

(To be Continued.)

## *On the Commercial Economy of Working Steam Expansively in Marine Engines.** By Mr. Edward E. Allen, of London.

(Continued from page 401. Vol. xxxi.)

In order to give a more complete view of the difference between the economy resulting from the increased expansion of ordinary steam, and that arising from the increase of pressure of the steam itself, the two following series of Tables, Nos. XXII., and XXIII., have been compiled.

The first series, XXII., is based on the supposition that the size of the engines is increased to 1½, 2, 2½, and 3 times for expansive working; but that from improved machinery and reduction in the weight of boilers (from diminished consumption of fuel), the gross weight of machinery and the space occupied remain constant.

The second series, XXIII., is based on the supposition that the size of the engines remains constant, as well as the gross weight of machinery, and the space occupied; but that the pressure increases from 35 lbs. to 60, 80, 100, and 120 lbs.

Table XXII.—Section A.

*Table showing the weights of machinery and coal, and joint weights of same; the size or nominal* H. P. *increasing from* 1 *to* 3, *the indicated* H. P. *remaining the same.*

| Class. | Service. | Ratio of size or nominal H. P. | Gross weight of machinery constant* | Ratio of weight of coal corresponding to increased nominal H. P. | Ratio of total weights. | Ratio of time the coal would last, if total weights be kept the same. | Ratio in days. |
|---|---|---|---|---|---|---|---|
| 1 | River. | 1 | 1 | ·25 | 1·25 | 1·00 | 2¼ |
| | | 1½ | 1 | ·20 | 1·20 | 1·23 | 2¾ |
| | | 2 | 1 | ·18 | 1·18 | 1·40 | 3½ |
| | | 2½ | 1 | ·16 | 1·16 | 1·58 | 4 |
| | | 3 | 1 | ·14 | 1·14 | 1·75 | 4¼ |
| 2 | Coasting and Continental. | 1 | 1 | 1·00 | 2·00 | 1·00 | 10 |
| | | 1½ | 1 | ·81 | 1·81 | 1·23 | 12¼ |
| | | 2 | 1 | ·71 | 1·71 | 1·40 | 14 |
| | | 2½ | 1 | ·63 | 1·63 | 1·58 | 15¾ |
| | | 3 | 1 | ·57 | 1·57 | 1·75 | 17½ |
| 3 | Ocean (short voyages) and Government. | 1 | 1 | 1·50 | 2·50 | 1·00 | 15 |
| | | 1½ | 1 | 1·21 | 2·21 | 1·23 | 18½ |
| | | 2 | 1 | 1·06 | 2·06 | 1·40 | 21 |
| | | 2½ | 1 | ·94 | 1·94 | 1·58 | 23¾ |
| | | 3 | 1 | ·85 | 1·85 | 1·75 | 26¼ |
| 4 | Ocean (long voyages). Australian. | 1 | 1 | 4·00 | 5·00 | 1·00 | 40 |
| | | 1½ | 1 | 3·24 | 4·24 | 1·23 | 49¼ |
| | | 2 | 1 | 2·84 | 3·84 | 1·40 | 56 |
| | | 2½ | 1 | 2·52 | 3·52 | 1·58 | 63¼ |
| | | 3 | 1 | 2·28 | 3·28 | 1·75 | 70 |
| 5 | Ocean (voyage out and home), Eastern Steam Navigation Company. | 1 | 1 | 7·00 | 8·00 | 1·00 | 70 |
| | | 1½ | 1 | 5·67 | 6·67 | 1·23 | 86 |
| | | 2 | 1 | 4·97 | 5·97 | 1·40 | 98 |
| | | 2½ | 1 | 4·41 | 5·41 | 1·58 | 110¼ |
| | | 3 | 1 | 3·99 | 4·99 | 1·75 | 122½ |

* Weight of boilers and water supposed to be reduced, and weight of engines not increased in higher ratio.

* From the London Artizan, Feb. and April, 1856.

In both series of Tables, XXII. and XXIII.,
Sections A refer to the total weights.
Sections B " " spaces.
Sections C " " cargo-space.
Sections D give a summary of the preceding sections.

TABLE XXII.—SECTION B.

*Tables showing the spaces occupied by engines, boilers, and passages together, and by coals; and also the ratio of the total spaces; the size or nominal* H. P. *increasing from* 1 *to* 3, *the indicated* H. P. *remaining the same.*

| Class. | Service. | Ratio of size or nominal H. P. | Space occupied by engines, boilers, and passages constant. * | Ratio of spaces occupied by coals. | Ratio of total spaces. |
|---|---|---|---|---|---|
| 1 | River. | 1 | 3 | 1·00 | 4·00 |
| | | 1½ | 3 | ·81 | 3·81 |
| | | 2 | 3 | ·71 | 3·71 |
| | | 2½ | 3 | ·63 | 3·63 |
| | | 3 | 3 | ·57 | 3·57 |
| 2 and 3 | Coasting and Continental, and Ocean (short voyages). | 1 | 3 | 3·00 | 6·00 |
| | | 1½ | 3 | 2·43 | 5·43 |
| | | 2 | 3 | 2·13 | 5·13 |
| | | 2½ | 3 | 1·89 | 4·89 |
| | | 3 | 3 | 1·71 | 4·71 |
| 4 and 5 | Ocean (long voyages), and voyage out and home. | 1 | 3 | 5·00 | 8 00 |
| | | 1½ | 3 | 4·05 | 7·05 |
| | | 2 | 3 | 3·55 | 6·55 |
| | | 2½ | 3 | 3·15 | 6·15 |
| | | 3 | 3 | 2·85 | 5·85 |

* Space occupied by boilers and passages, supposed to be reduced, and space occupied by engines not increased in higher ratio.

Tables XXII. show the results of increased expansion of ordinary steam.

Sections A and B show how the total weights of machinery and coals taken together, and also the total spaces occupied by them, decrease from Classes 1 to 5, on the supposition that the gross weight of machinery and the space occupied by it remain constant.

Section C shows how the cargo-space continually increases from Class 1 to 5.

Section D gives a general summary of the three preceding ones, and shows the per centage of increase of time the coals would last, if the total weights of machinery and coals taken together, were the same; and as this depends upon the saving in coal alone, the weight of machinery being supposed constant, it amounts to the same in all the classes; being equal to 40 per cent. if the engines be doubled in size, and 75 per cent. if the engines be increased to three times the size.

The two last columns in Table XXII., Section D, give the annual per centage gain on the capital, from saving in coal and gain in cargo-space; first, when the net profits cover the cost of vessel in one year; and, second, when the net profits cover the cost of vessel in two years; the

total machinery and coal space being taken at two-thirds of the total cargo-space in each case.

TABLE XXII.—SECTION C.

*Table showing the gain in* CARGO SPACE, *when the space occupied by the engines, boilers, and passages is constant;* the size or nominal* H. P., *increasing from* 1 *to* 3 *the indicated* H. P. *remaining the same.*

| Class. | Service. | Ratio of size or nominal H. P. | Ratio of total spaces occupied by machinery and coals, from foregoing table. | The same ratio, but showing the per centage decrease. | Per centage gain in cargo-space. 1st. When total machinery and coal space is *equal* to total cargo-space. | 2d. When total machinery and coal space is ⅔ of total cargo-space. | 3d. When total machinery and coal space is ½ of total cargo-space. |
|---|---|---|---|---|---|---|---|
| | | | | | Per cent. | Per Cent. | Per Cent. |
| 1 | River. | 1 | 4·00 | 100 | — | — | — |
| | | 1½ | 3·81 | 95 | 5 | 3⅓ | 2½ |
| | | 2 | 3·71 | 93 | 7 | 4⅔ | 3½ |
| | | 2½ | 3·63 | 91 | 9 | 6 | 4½ |
| | | 3 | 3·57 | 89 | 11 | 7⅓ | 5½ |
| 2 and 3 | Coasting and Continental, and Ocean (short voyages.) | 1 | 6·00 | 100 | — | — | — |
| | | 1½ | 5·43 | 90 | 10 | 6⅔ | 5 |
| | | 2 | 5·13 | 85 | 15 | 10 | 7½ |
| | | 2½ | 4·89 | 81 | 19 | 12⅔ | 9½ |
| | | 3 | 4·71 | 78 | 22 | 14⅔ | 11 |
| 4 and 5 | Ocean (long voyages,) and voyage out and home. | 1 | 8·00 | 100 | — | — | — |
| | | 1½ | 7·05 | 88 | 12 | 8 | 6 |
| | | 2 | 6·55 | 82 | 18 | 12 | 9 |
| | | 2½ | 6·15 | 77 | 23 | 15⅓ | 12½ |
| | | 3 | 5·85 | 73 | 27 | 18 | 13½ |

* Space occupied by boilers and passages supposed to be reduced, and space occupied by engines not increased in higher ratio.

It is only on the supposition that the net profits for a given period cover the cost of vessel or capital, that the gain from increase of cargo-space can be added to the gain from saving in coal. If the vessel be supposed to have cost a sum equal to the net profits of three or any number of years, then, in order to find the total annual gain, it is only necessary to divide the annual per centage gain from the increase of cargo-space by 3, or any number determined on, and add the quotient to the annual per centage gain from saving in coal; the sum will be the gross annual per centage gain on capital.

Tables XXIII. show the results of increase of pressure of the steam itself.

The use of Section A may be thus illustrated; taking the 2d class of steamers, it is seen that if steam of 35 lbs. pressure be used and cut off at ¾ths, a weight of coal equal to the weight of machinery will last ten

days; but if steam of 80 lbs. pressure be used (in the same sized cylinder), then the same power will be developed by a consumption of 43 per cent. of the fuel, the steam being cut off at $\frac{3}{20}$ths; and a weight of coal equal to the weight of machinery would last 23 days instead of 10. In like manner, if steam of 120 lbs. pressure be used (also in the same sized cylinder), then the same power will be developed by a consumption of 35 per cent. of the fuel, the steam being cut off at about $\frac{1}{12}$th; and a weight of coal equal to the weight of machinery would last 28 days instead of 10. In all the other classes of steamers the same proportions hold good.

TABLE XXII.—SECTION D. GENERAL SUMMARY.

*Table compiled from the three foregoing Tables; the cost, weight, and space of engines, boilers, and passages, and water, being constant; the size or nominal* H. P. *increasing from* 1 *to* 2 *and* 3 *times (the intermediate sizes being omitted), the indicated* H. P. *remaining the same.*

| Class. | Service. | Ratio of size or nominal H. P. | Annual saving of coal in per centage of capital (Table XVIII). | Increase of capital per cent. | Total weight of coal and machinery: decrease per cent (deduced from column 6, section A). | Total spaces occupied by coal and machinery: decrease per cent. (deduced from column 6, section B). | Cargo space: increase per cent. 1st. When total machinery and coal space is *equal* to total cargo-space. | 2d. When total machinery and coal space is 25*ths* of total cargo-space. | 3d. When total machinery and coal space is *half* of total cargo-space. | Per centage of increase of time the coals would last, if total weights be kept the same. | Number of days the coals would last, if total weights be kept the same. | Annual per centage gain of capital from saving of coal and increase of cargo-space. If the net profits cover cost of vessel in one year. | If the net profits cover cost of vessel in two years. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Per Cent. | | Per Cent. | Per Cent. | Per Cent. | Per Cent. | Per Cent. | Per Cent. | | Per Cent. | Per Cent. |
| 1 | River. | 1 | ... | Capital constant; cost of boilers supposed to be reduced, and cost of engines not increased in higher ratio. | .... | .... | .... | .... | .... | .... | 21½ | .... | .... |
| | | 2 | 4·35 | | 5·60 | 7 | 7 | 43⅔ | 31¼ | 40 | 30⅞ | 9·01 | 6·68 |
| | | 3 | 6·45 | | 8·80 | 11 | 11 | 71⅔ | 51½ | 75 | 41¼ | 13·78 | 10·11 |
| 2 | Coasting and Continental. | 1 | ... | | .... | .... | .... | .... | .... | .... | 10 | .... | .... |
| | | 2 | 1·46 | | 14·50 | 15 | 15 | 10 | 7¼ | 40 | 14 | 11·45 | 6·45 |
| | | 3 | 2·15 | | 21·50 | 22 | 22 | 14⅔ | 11 | 75 | 17½ | 16·81 | 9·48 |
| 3 | Ocean (short voyages) and Government | 1 | ... | | .... | .... | .... | .... | .... | .... | 15 | .... | .... |
| | | 2 | 1·45 | | 17·00 | 15 | 15 | 10 | 9 | 40 | 21 | 11·45 | 6·45 |
| | | 3 | 2·15 | | 26·00 | 22 | 22 | 14⅔ | 13½ | 75 | 26¼ | 16·81 | 9·48 |
| 4 | Ocean (long voyages) Australian. | 1 | ... | | .... | .... | .... | .... | .... | .... | 40 | .... | .... |
| | | 2 | 7·25 | | 23·20 | 18 | 18 | 12 | 7½ | 40 | 56 | 19·25 | 13·25 |
| | | 3 | 10·75 | | 34·48 | 27 | 27 | 18 | 11 | 75 | 70 | 28·75 | 19·75 |
| 5 | Ocean (voyage out and home). | 1 | ... | | .... | .... | .... | .... | .... | .... | 70 | .... | .... |
| | | 2 | 1·45 | | 25·37 | 18 | 18 | 12 | 9 | 40 | 98 | 13·45 | 7·45 |
| | | 3 | 2·15 | | 37·02 | 27 | 27 | 18 | 13½ | 75 | 122½ | 20·15 | 11·15 |

Sections A and B show how the total weights of machinery and coals taken together, and also the total spaces occupied by them, decrease from Class 1 to 5, owing to a saving of coals alone. No advantage has been taken of the decrease in the space required for the boilers, although much less fuel is used; because high-pressure boilers usually occupy more space, for the same power, than low-pressure boilers.

Section C shows how the cargo-space continually increases from Class 1 to 5.

The last section of Table XXIII. gives a general summary of the three preceding ones.

TABLE XXIII.—SECTION A.

*Table showing the* WEIGHTS *of machinery and coal, and joint weights of same; the total pressure increasing from* 35 *to* 60, 80, 100, *and* 120 *lbs. per square inch; the size or nominal* H. P. *of the engines, the indicated* H. P., *and the gross weight of machinery remain the same.*

| Class. | Service. | Total pressure of steam in lbs. per square inch. | Weight of machinery supposed constant. | Ratio of weight of coal corresponding to increased pressure. | Ratio of total weights. | Ratio of time the coal would last, if total weights be kept the same. | Ratio in days. |
|---|---|---|---|---|---|---|---|
| 1 | River. | 35 | 1 | ·25 | 1·25 | 1·00 | 2½ |
| | | 60 | 1 | ·132 | 1·132 | 1·88 | 4¾ |
| | | 80 | 1 | ·109 | 1·109 | 2·32 | 5¾ |
| | | 100 | 1 | ·095 | 1·095 | 2·63 | 6½ |
| | | 120 | 1 | ·087 | 1·087 | 2·85 | 7 |
| 2 | Coasting and Continental. | 35 | 1 | 1·00 | 2·00 | 1·00 | 10 |
| | | 60 | 1 | ·53 | 1·53 | 1·88 | 19 |
| | | 80 | 1 | ·43 | 1·43 | 2·32 | 23 |
| | | 100 | 1 | ·38 | 1·38 | 2.63 | 26 |
| | | 120 | 1 | ·35 | 1·35 | 2·85 | 28 |
| 3 | Ocean (short voyages) and Government. | 35 | 1 | 1·50 | 2·50 | 1·00 | 15 |
| | | 60 | 1 | ·795 | 1·795 | 1·88 | 28 |
| | | 80 | 1 | ·645 | 1.645 | 2·32 | 35 |
| | | 100 | 1 | ·570 | 1·570 | 2·63 | 39½ |
| | | 120 | 1 | ·525 | 1·525 | 2·85 | 42¾ |
| 4 | Ocean (long voyages). Australian. | 35 | 1 | 4·00 | 5·00 | 1·00 | 40 |
| | | 60 | 1 | 2·12 | 3·12 | 1·88 | 75 |
| | | 80 | 1 | 1·72 | 2·72 | 2·32 | 93 |
| | | 100 | 1 | 1·52 | 2·52 | 2·63 | 105 |
| | | 120 | 1 | 1·40 | 2·40 | 2·85 | 114 |
| 5 | Ocean (voyage out and home). Eastern Steam Navigation Company. | 35 | 1 | 7·00 | 8·00 | 1·00 | 70 |
| | | 60 | 1 | 3·71 | 4·71 | 1·88 | 132 |
| | | 80 | 1 | 3·01 | 4·01 | 2·32 | 162 |
| | | 100 | 1 | 2·66 | 3·66 | 2·63 | 184 |
| | | 120 | 1 | 2·45 | 3·45 | 2·85 | 200 |

It will render the results of these tables more easily understood, to trace them out with reference to one of the five classes of steamers, and as one of the most important, Class 4, or the Australian vessels, may be taken. From Table I. it will be seen that the quantity of coal usually taken is

equal to about four times the gross weight of machinery, and that this quantity lasts about forty days, that is, with 35 lbs. steam, cut-off at three-fourths of the stroke. From table VIII. it will also be seen that the quantity of coal annually consumed, if the vessels be kept at work, amounts to 25 per cent. of the cost of the vessels or capital.

TABLE XXIII.—SECTION B.

*Table showing the* SPACES *occupied by engines, boilers, and passages together, and by coals; and also the ratio of the Total Spaces; the total pressure increasing from* 35 *to* 60, 80, 100, *and* 120 *lbs. per square inch; the size or nominal* H. P. *of the engines, the indicated* H. P., *and the total space occupied by machinery remaining the same.*

| Class. | Service. | Total pressure of steam in lbs. per square inch. | Space occupied by engines, boilers and passages constant. | Ratio of spaces occupied by coals. | Ratio of total spaces. |
|---|---|---|---|---|---|
| 1 | River. | 35 | 3 | 1·00 | 4·00 |
| | | 60 | 3 | ·53 | 3·53 |
| | | 80 | 3 | ·43 | 3·43 |
| | | 100 | 3 | ·38 | 3·38 |
| | | 120 | 3 | ·35 | 3·35 |
| 2 and 3 | Coasting and Continental, and ocean (short voyages). | 35 | 3 | 3·00 | 6·00 |
| | | 60 | 3 | 1·59 | 4·59 |
| | | 80 | 3 | 1·29 | 4·29 |
| | | 100 | 3 | 1·14 | 4·14 |
| | | 120 | 3 | 1·05 | 4·05 |
| 4 and 5 | Ocean (long voyages), and voyage out and home. | 35 | 3 | 5·00 | 8.00 |
| | | 60 | 3 | 2·65 | 5·65 |
| | | 80 | 3 | 2·15 | 5·15 |
| | | 100 | 3 | 1·90 | 4 90 |
| | | 120 | 3 | 1·75 | 4·75 |

Upon referring to Section D., Table XXII., it appears that if the cylinders be doubled in capacity, to allow of more expansive working, the coal required for the same time and to develop the same power is so far reduced, that $7\frac{1}{4}$ per cent. per annum is saved on the original capital; and that if the weight of coals carried be kept the same, they will last fifty-six days instead of forty. Also, if the cylinders be increased in capacity to three times, the annual saving in coal will amount to $10\frac{3}{4}$ per cent. on the original capital; and if the same weight of coals be carried, they will last seventy days instead of forty.

TABLE XXIII.—SECTION C.

*Table showing the Gain in* CARGO SPACE, *when the space occupied by the engines, boilers, and passages is constant; the total pressure increasing from* 35 *to* 60, 80, 100, *and* 120 *lbs. per square inch; the size or nominal* H. P. *of the engines, and the indicated* H. P. *remaining the same.*

| Class. | Service. | Total pressure of steam in lbs. per square inch. | Ratio of total spaces occupied by machinery and coals, from foregoing table. | The same ratio, but showing the per centage decrease. | Per centage gain in cargo-space. | | |
|---|---|---|---|---|---|---|---|
| | | | | | 1st. When total machinery and coal-space is *equal* to total cargo-space. | 2d. When total machinery and coal-space is 2-3*ds* of total cargo-space. | 3d. When total machinery and coal-space is *half* of total cargo-space. |
| | | | | | Per cent. | Per cent. | Per cent. |
| 1 | River. | 35 | 4·00 | 100 | | | |
| | | 60 | 3·53 | 88 | 12 | 8 | 6 |
| | | 80 | 3·43 | 86 | 14 | 9½ | 7 |
| | | 100 | 3·38 | 84 | 16 | 10⅔ | 8 |
| | | 120 | 3·35 | 83 | 17 | 11⅓ | 8½ |
| 2 and 3 | Coasting and Continental, and Ocean (short voyages). | 35 | 6·00 | 100 | — | — | — |
| | | 60 | 4·59 | 76 | 24 | 16 | 12 |
| | | 80 | 4·29 | 71 | 29 | 19½ | 14½ |
| | | 100 | 4·14 | 69 | 31 | 20⅔ | 15½ |
| | | 120 | 4·05 | 67 | 33 | 22 | 16½ |
| 4 and 5 | Ocean (long voyages) and voyage out and home. | 35 | 8·00 | 100 | — | — | — |
| | | 60 | 5·65 | 71 | 29 | 19½ | 14½ |
| | | 80 | 5·15 | 64 | 36 | 24 | 18 |
| | | 100 | 4·90 | 61 | 39 | 26 | 19½ |
| | | 120 | 4·75 | 59 | 41 | 27⅓ | 20½ |

(To be continued.)

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For the Journal of the Franklin Institute.

## *Extracts from the Diary of* CHARLES SCHINZ, *Consulting Chemist of Camden, New Jersey, during a Journey in Europe.*

Visiting the establishment of a morocco tanner, I saw a very simple thing, which, however, I found extremely practical and economical. These are the many vats wanted to plunge the skins in to impregnate them with different substances. These vats used to be made either of wood or large plates of sandstone; both were costly and required repairs, and the former, especially, lasted only a limited number of years. Now, these vats are made of a more durable and less costly material, namely, of what is called beton.

This beton consists only of small stones, such as are deposited at the bottom of brooks of a rapid current, and lime, which, if poor enough, may be used without mixing any sand with it; if the lime is rich, (contains few other substances but real lime,) one-half of its volume of fine sand may be mixed with it.

A layer of six inches of stone is laid in the form of the basin, well, or other object to be formed; the lime, previously slacked with little water so as to form a rather thick paste, is poured over it, and the stones and lime mixed, not by moving them, but by beating the lime into the space left between the stones with a pointed instrument. This requires some skill, and some time, and some experience, but the specimens I have seen of such work, testify its perfect tightness and great hardness.

The bottom of the vat is first made like any other floor, only in proportion to the size of the vat; then a hollow box of wood of the shape of the interior empty space of the vat, is solidly fixed against the bottom, by fastening it very tightly from above; this is important, as if this inner mould is not fixed tightly, it is subsequently raised and pushed in all directions. Round this inner mould, and at the distance of the thickness to be given to the wall, another box made of board, is gradually built, so as to give space to the workman to fill in and to work the materials. These walls vary according to the size of the vat, between 3 and 6 inches in thickness. They are very smooth and hard, but it requires several weeks to let them dry before they can be used.

In the same establishment, I have seen a large cellar also made of beton. In this case the mould was only dug in the earth, and the bottom placed in it after the earth serving as a mould had been dug out. This cellar is vaulted as artistically as any I have seen before, and costs considerably less than the same construction would have cost built with bricks or with stones, and looks as smooth as if it had been cut out from one soft sandstone.

The hardness of the well-dried beton, is, indeed, as great, or even greater than any other material.

The proprietors have also made all their flooring in the shop with beton, and laid out a good many flues to draw off water, which have been covered also with beton so as to make the floor perfectly even and smooth.

I have no doubt but all kinds of smaller stones might be used for the formation of beton-work, but not all kinds of lime might be found to answer quite well; it should have more of the properties of cement and harden very quickly. To acquire this part of the art may require some study, but, I should think this to be well worth time; the applications of this kind of work are very manifold, and as useful and convenient as economical.

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In spite of the crisis in America, in the year 1855 to '56, and the war with Russia, which caused me to expect that manufactures in my native land, (Switzerland,) should rather be suffering, I found quite the contrary. The manufacturers of silks and print-work are as busy as ever, and have of late years extended themselves in a most astonishing degree.

In the establishment of one of my friends, a large silk dyer, I found a practical improvement in the process of removing the color and the gum from the silk to make it fit to receive the color, which, through its analogy with many other chemical processes, deserves attention.

Formerly, the raw silk was simply boiled at a rapid ebullition in soap-water to effect the above mentioned purpose. This had, however,

the great inconvenience that the threads of the silk were much tangled together, so that the process of winding the silk afterwards, was quite difficult and attended with loss.

Now, the raw silk is simply suspended in strings on sticks, and a large quantity at once suspended by means of these sticks in a large square box of heavy oak-wood, closed by a heavy lid of the same material, and fastened very tightly by means of screws. The silk is previously immersed in a strong solution of soap, and after the box is fastened, a jet of steam is introduced with a pressure of about 4 atmospheres (60 lbs.) The results thus obtained, are very superior to those attained by the old process, though the new process requires less time and expense.

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About 12 years back, before I settled in the United States, I had to furnish to a bleaching establishment in the Canton of St. Galls, the plans for a gas apparatus for wringing cotton goods, which, on visiting there, I have seen now, for the first time in operation.

The gas for such purpose, needs, of course, not to be of illuminating properties, but should yield a very hot flame. This condition caused me to choose a mixture of equal volumes of hydrogen gas and oxide of carbon.

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|---|---|---|---|
| 1 Cubic foot of Hydrogen Gas produces | | 205 | units of heat. |
| 1 " | Oxide of carbon, " | 207 | " |
| | | 412 | " |

The capacity of heat of the products of combustion, viz:

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|---|---|---|---|
| 1 Cubic foot Steam, | . | = 0·029000 | } 0·080869. |
| 1 " | Carbonic Acid, | = 0·028942 | |
| 4 " | Nitrogen, . . | = 0·022927 | |

divided into that quantity of heat $= \frac{412}{0{\cdot}080869}$ give the intensity of the flame as 5095° Cent. = 9203° Fah.

Now, the experience of a number of years show, that the production of 3000 cubic feet of that gas mixture, to wit: the firing of two retorts for 12 hours effected with

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| 800 lbs. Wood equivalent to 400 lbs Anthracite, which cost, for instance, in Philadelphia, at $ 5 per ton, . | $ 2·00 |
| 54 lbs. Charcoal at 1 c. per pound, . | ·54 |
| Add for labor, interest, and wear and tear, . . | ·83 |
| | $ 3·37 |
| Thus we find the 1000 cubic feet to cost only | 1·12 |

No other gas would cost less, and none would answer as well the purpose, as it is important that no soot be deposited on the goods.

The process by which these results are obtained, and the apparatus used therefor, are very simple.

There are two perpendicular retorts of cast iron, connected by a horizontal tube below the furnace; above the furnace, one of the retorts gives issue to the gases by a common gas pipe. A similar pipe is connected with the top of the other retort and issues from a very small steam boiler, in which steam is generated by the waste heat of the furnace.

Both retorts are filled with charcoal and when these are red hot the steam is admitted. This steam is simply decomposed by the char-

coal; the oxygen forms oxide of carbon, and the hydrogen is freed and goes off in equal volumes with the oxide of carbon.

The tops and bottoms of the retorts are provided with lids, constructed like safety valves, so that they may periodically be replenished with charcoal, and the cinders from the consumed charcoal taken out from time to time at the bottom.

These retorts have but six inches diameter; are exposed to the fire four feet high, and are made of cast iron.

It has lately been suggested to procure pure hydrogen from such a mixture of oxide of carbon and hydrogen, by passing the gases through a mixture of quicklime and caustic soda, enclosed also in a red hot tube. In this process the water contained in the caustic soda is again decomposed, its oxygen combines with the oxide of carbon to produce carbonic acid, and the hydrogen is made free. Most of the carbonic acid thus formed combines with the soda, and some that goes through may well be separated by the commonly used means.

There may come a time and the opportunity when such a production of large quantities of free hydrogen may be most desirable, and I have no doubt that such a process may prove practical and sufficiently economical.

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The high price of rags for the manufacture of paper, has of late years, induced many persons to seek for substitutes for this scarce material. Any kind of vegetable fibres has been subsequently suggested. The paper manufacturers in the United States had a still greater inducement to seek for such a substitute, than the Europeans, where rags are to be had at a reasonable price, and therefore, I suppose that great improvements have been made in the former country to that purpose; yet it may be of interest to hear of the exact results and the apparatus which I have seen in one of the most renowned paper-mills in this country.

Very white kinds of wood are here used, not exactly as a substitute for rags, but as a cheap and good material to be mixed in variable proportions with the paper pulp derived from rags.

The machine which reduces the wood to a pulp as fine as the common paper pulp, consists in a large circular stone of about 4 feet diameter and 3 feet thick. It moves on a horizontal axle with a speed of about 12 feet per second. On the front side of the stone a system of screws moved by the machinery are so placed as to press about 12 pieces of wood against the grinding circular surface of the stone. Any of the screws arrests its motion as soon as the wood behind it is scraped off, so that it may be rearranged with a new piece at any time.

From the top of the grinding stone, a tolerably large quantity of water comes in in a jet; this causes the fine particles of wood to be transformed immediately into a thin pulp, which is washed off continuously into a basin below the grindstone.

From the basin the pulp goes through a sieve, which arrests all coarse parts of the wood which might go into the pulp.

The thus purified thin pulp then goes into a square box, in which a hollow cylinder covered with wire cloth is made to revolve. This cloth is of such fineness, that only the coarsest part of the wood pulp is arrested on its surface, and forms there something like a new formed sheet of

paper, which, by means of a roller and a scraper, is taken off and collected into a receiver standing behind the cylinder.

All the finer parts of the pulp and the water go through the wire cloth, and are by means well known, collected as a thin pulp in the hollow axle of the cylinder, which pours its contents into a second square box in which another cylinder covered with a somewhat finer wire cloth, separates again those of the wood fibres that come next in size to those separated by the first cylinder. This is repeated five times, so that there are five qualities of wood fibre collected, each different in quality. This separation is required, because the coarser qualities have to be subjected to the action of the common paper engine, where they are mixed with the rag pulp.

The wood engine requires the power of 24 horses, and furnishes in 24 hours, 2400 lbs. of dry good pulp.

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| 24 horse power cost per hour about 192 lbs. to 200 lbs. Anthracite, at $ 5 per ton, . . . . . | ·50 |
| This power reduces to pulp 100 lbs. wood, which cost about | ·25 |
| Then 100 lbs. of the dry pulp cost, including labor, | ·25 |
| | $ 1·00 |

This is, indeed, cheaper than any kind of rags, and as there is no loss of matter, and the pulp requires no bleaching for most purposes, this substitute is of great practical value.

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Since several years it has been a subject of study to many chemists to produce different preparations from the vegetable fuel called turf.

Most have succeeded in obtaining from the turf a variety of empyreumatic oils, as lubricating oil which has been applied to various purposes, besides this, a small quantity of paraffine is obtained, from which very fine candles are made which resemble much those of sperm. And finally, a residue of a kind of very porous and well burning coke is obtained.

These products, however, are but of small value against the value of the turf itself in those countries where fuel is scarce and dear. It is used with a greater pecuniary advantage as a fuel, so, for instance, all the locomotives of the railroads in Bavaria are fed with dried turf, and as these railroads pass through a good many fields where this material occurs abundantly, it is evident that this employment is advantageous.

However, the turf requires a good deal of time and good weather to become well seasoned; it requires very large store houses to keep it dry and to store it for such seasons when it cannot be dried. The volume of the common turf is very considerable compared with its power as a fuel, and even to make use of it as a fuel, it demands a great deal of labor to the fireman.

Besides these inconveniences, the best seasoned turf has the property to be very hygroscopic, a quality which lessens much its heating power. It contains 30 to 40 per cent. of water, which on being evaporated when brought into the fire place, absorbs great quantities of heat which escapes with the steam through the chimney.

The attempt to reduce the volume of the turf, to make it less porous, and hence less hygroscopic, has been made frequently, but many times

with questionable success. The administration of the Bavarian railroads have caused a great many experiments to be made; they have chiefly applied themselves to effect the desired end by pressing the turf by means of powerful hydraulic presses, but found that this was too slow and expensive.

In the regions of the river Aar in the western part of Switzerland, there are very extensive turf fields, so extensive that they are almost worthless, though the turf be of good quality. But as there is very little manufacturing industry the value of this voluminous fuel is very limited.

I have seen there an establishment not yet at work, which has been formed by a joint stock company with a capital of 150,000 francs, and which proposes to manufacture from the raw turf a kind of fuel which has only $\frac{1}{8}$th of its original volume and is so very hard and compact, and without the property to absorb moisture from the air, that one may indeed, expect the most favorable results from this enterprise as this prepared fuel may well support the freight to places where fuel is more in demand.

The means of making such a beautiful condensed turf as is shown by samples, are very simple; they consist simply in reducing the turf to a fine pulp, to strain the pulp through a fine sieve, to dilute it with sufficient water to allow the earth and fine sand mixed in the raw turf, to deposit themselves at the bottom and to conduct the pulp in large reservoirs where the water goes off, and to mould the very thick pulp like bricks without pressure, and finally, to dry these bricks first in the open air and then in a hot place.

I will try to describe the machinery which is nearly completed for that purpose.

To render the transport of the raw turf to the place where it is manufactured as cheap as possible, canals are cut in the ground leading from the places where the turf is dug to the place where it is manufactured; the raw material is then very easily conveyed to the place where it is wanted. Behind the working machinery, and reaching into the boats in which the material has been deposited, goes a hoisting-machine which, with the help of a man, carries the material from the boat to an elevation of about 20 feet, where it drops its charge into a sort of a funnel.

Below this funnel, are two cylinders armed with nails or spikes standing out from the circumference, these being placed and contrived so as to move in opposite directions, tear the soft and wet turf into small pieces.

These small pieces fall down upon another cylinder which revolves also in a large flue which forms a continuance of the funnel. This cylinder at its circumference is armed with a large number of curved blades of steel, which strike in their revolution against one projecting horizontal blade, with which they effect something like the cut of a pair of scissors. Above this cutting apparatus a stream of water is introduced from both sides of the funnel, so as to clean the cylinder and to suspend the particles of the turf so as to form a pulp. From beneath this second cutting cylinder, the funnel is divided in two branches which lead the pulp in two cylindrical boxes. These are made of sheet iron and

are each formed of two cylinders of which one is placed within the other, so as to leave an empty space of a few inches between. The surface of the inner cylinder is perforated by small holes, a perpendicular axle bearing four wings is moving rapidly in this inner box and causes by its motion all the fine particles of the pulp to go through the above mentioned small holes, whereas all coarser parts remain in the interior and may be removed from time to time. The outer box of course, serves as a receiver for the fine pulp and communicates, by pipes with very large vats, which receive the pulp at about the middle of their height. In these vats there are also perpendicular axles and wings which keep its contents in motion; to facilitate this motion a certain quantity of water goes through the axle and is introduced from below. At the upper rim of these vats a circular receiver surrounds the vat, into which the contents of the vat overflow constantly. The chief purpose of these vats is to dilute the pulp sufficiently to cause the sand and earth to separate from the vegetable matter and to deposit itself to the bottom.

From the outer rim which receives the overflow, a series of flues lead the thin pulp into very large reservoirs dug in the ground, where the excess of water partly evaporates and partly goes through the bottom. These reservoirs are about 3 feet deep, 50 feet in length, and 25 breadth.

Round these reservoirs are very light wooden buildings with shelves, for the purpose of receiving the pieces of manufactured turf and of drying them by the common draft of the air. These pieces are made from the pulp after it has taken sufficient consistency in the reservoirs, and are formed exactly as bricks are formed from clay.

After the turf bricks have sufficiently dried in the air, they are removed to a hot dry-room where they acquire full hardness, so as to be ready for sale.

The whole machinery is moved by a steam engine of 15 horse-power.

What amount of manufactured turf will the power of 15 horses furnish? This is now the great question!! I shall not anticipate the soon expected results, by any opinion, but the samples of this new preparation are so fine that they excite the most partial expectations, and the whole business is well worth the attention of all who care for improvements in the arts.

Close to this establishment, there is an opposition one. There the newly dug turf is simply ground between two stones like those used for grinding fruit for the manufacture of cider. The paste which issues between the two stones is immediately formed into bricks and simply dried in the open air.

I do not know what amount of power is consumed to produce a certain quantity of manufactured turf. The samples I have seen of this preparation keep the mean between raw turf and the produce of the above described establishment; they are still porous but tolerably hard, and may as a fuel answer tolerably well.

In the neighborhood of these establishments, I visited also, some old friends who are paper manufacturers. There I saw a new construction of steam boilers, manufactured by Bryan, Donkins, & Co., London, which I will describe as a curiosity. The boiler has two interior fire places at each opposite end of the cylinder, which is the shape of the boiler.

These fire boxes, however, are rather small and take up only one-fourth of the circular bore of the cylinder; they are exactly opposite to each other, so that the flames go in opposite directions and meet in the middle of the boiler; then both currents mix and are directed towards the bottom of the boiler, on the bottom the flue turns on the other side of the boiler, and divides itself again in opposite directions and goes through a system of pipes which issue both at opposite ends of the boiler from where the gases of combustion are again re-united in the chimney.

Machinists are as fond of, and as subject to, fashion and change of dress as ladies; in this instance, at least, I cannot discover what advantage is gained by making complicated what we know to answer better if made simple.

(To be Continued.)

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For the Journal of the Franklin Institute.

## *Remarks on the Gyroscope.*

The remarks of your correspondent, Mr. Allen, in the last number of the *Journal*, on the subject of the Gyroscope—although apparently, in the main correct, and the best explanation I have yet seen of the instrument, are not, in all respects, consistent with the facts of the case.

It is, no doubt, the "inertia of the plane of rotation," that keeps the instrument in its place during the rotation of the wheel. The action of this force is easily proved by holding it in the hand when in rapid motion. The resistance it offers when an attempt is made to change the plane is very perceptible.

Your correspondent says, "the tendency of the instrument to rise does not overcome the force of gravity, does not quite equal it." On the contrary, in the instrument I possess, this tendency overcomes gravity so completely, that it sometimes assumes a position so nearly vertical as to slip off the point of suspension.

If this tendency is increased in proportion, as gravity is overcome by the increased rapidity of the rotation at the wheel, an infinite rapidity ought to elevate it much above the horizontal position, which he asserts would be the one assumed.

The revolution of the instrument upon its point of suspension, is evidently the result of the combined forces of gravity and centrifugal force.

For if gravity is counteracted by other means, such as the suspension of a weight from the extended arm upon which the instrument revolves so as to balance it, the orbicular motion will cease.

Another peculiarity to which your correspondent does not allude, is the increased revolution upon the point of suspension in proportion to the decrease of the revolution of the wheel, as if it was essential that one's gain should compensate for the other's loss in keeping the whole suspended.

In case of gravity being counteracted, as before alluded to, the wheel being in motion, the orbicular motion ceases.

If, however, this motion be artificially produced, a force similar to, and in the direction of gravity is immediately the result, drawing the in-

strument or the balance downwards, according to the direction of the force applied, showing that two of the motions cannot exist without the third being produced. W.

*Germantown*, 6 *mo.* 18, 1856.

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## FRANKLIN INSTITUTE.

*Proceedings of the Stated Monthly Meeting, June* 19, 1856.

John Agnew, Vice-President, in the chair.

John F. Frazer, Treasurer.

Dr. B. H. Rand, Recording Secretary, pro tem.

The minutes of the last meeting were read and approved.

Letters were read from the Royal Imperial Geological Association, Vienna, Austria; and from the Royal Society of London.

Donations to the Library were received from the Royal Imperial Geological Association, Vienna; The Institute of Actuaries, London; Hon. Job R. Tyson, U. S. Congress; Major W. H. Emery, U. S. Top. Eng., Washington, D. C.; Trustees of the Free Library, New Bedford, Mass.; The Mercantile Library Association, City of New York; The Managers of the State Lunatic Asylum, Utica, New York; The Philadelphia Library Company, Dr. L. Turnbull, Messrs. Philip Price, and George W. Conarroe, Philadelphia.

Donations to the Cabinet of Minerals from Mr. Isaac H. Conrad, Philadelphia, and Capt. Samuel W. Dewey, Patrick Court-House, Virginia.

The Periodicals received in exchange for the Journal of the Institute, were laid on the table.

The Treasurer read his statement of the receipts and payments for the month of May.

The Board of Managers and Standing Committees reported their minutes.

The candidates for membership in the Institute, (4,) were proposed, and the candidates proposed at the last meeting, (5,) were duly elected.

Mr. Howson exhibited the model of an improved coal screen, invented by Mr. Isaac Harman, of Tamaqua, Pennsylvania, for which he has applied for a patent. The object of this invention is to avoid the use of a central shaft, with arms on which coal screens are usually suspended. By resting each end of the screen on the V shaped pulleys, it is retained in its proper position, although set at an angle of about one inch vertically to twelve inches horizontally; at the same time a rotary motion is easily imparted to the screen by turning a shaft, and without the intervention of ordinary gearing. By this arrangement no obstacle is offered to the introduction of masses of broken coal to the interior of the screen.

Another feature of this invention, is the introduction of a series of projections cast on the interior of the gratings, which have the effect of partially retarding the broken coal in its progress through the screen; thus

allowing the smaller particles every opportunity to pass through the openings in the grating.

Mr. Howson also exhibited the model of a machine for making pressed brick, invented by the same gentleman, and for which, application has been made for a patent.

This invention may be briefly described to consist in the employment for making bricks of sliding moulds, constructed in two halves, each half having any convenient number of angular recesses and projections. A horizontal reciprocating motion is imparted by means of a crank to the moulds, which are arranged to slide in suitable guides.

In addition to the reciprocating motion, the two halves of the guides are caused (during certain points in the movements of the machine,) to separate from, and come in contact with each other; the points of the angular projections of the two halves of the moulds always coinciding, so that the angular recesses of the halves, together, form oblong spaces of the form and size of the bricks to be manufactured.

A knife is used in connexion with the moulds, and so operated by means of rods and levers, that the moment the moulds are supplied with tempered clay, all communication between them and the reservoir above is cut off.

To the under-side of one-half of the moulds, is hinged a radial plate, so arranged in connexion with levers and latches, as to open and close during the movements of the machine, when closed forming the bottom for the moulds, and when open allowing the bricks formed in the moulds to escape therefrom; and to the upper-side of one-half of the moulds, is hinged a radial lid, having a plate with projections corresponding in shape to the spaces formed by the angular recesses of the moulds. This lid is alternately raised and lowered during the movements of the machine, raised when clay has to be admitted, and lowered so that in conjunction with the above-mentioned radial plate, the clay may be confined to the moulds at the time the two halves of the latter are brought together.

It will be understood, that the principal feature in this machine is the arrangement of the moulds, which expand when the clay is first admitted, and afterwards contract so as to condense the clay confined in the moulds, above and below, into a compact mass, making pressed bricks of a superior quality, and at a rapid rate.

Mr. James Dougherty, called the attention of the Institute to a mode of melting iron shavings, borings, or turnings, patented by Mr. Abiel Pevey, of Lowell, Massachusetts.

It consists in the use of cast iron vessels, of any convenient form, into which the shavings are closely packed and secured by a lid. They are then ready for use, and may be charged into the cupola with other iron, in any desirable quantity. The kind of vessel used by Mr. P., is a cylindrical pot with a tube through the centre, (which was exhibited,) and is a very convenient form.

The re-melting of iron shavings has always been a desideratum with those whose operations produce them in large quantities; but attempts heretofore made to melt them in open cupola, have been very unsatisfactory. They are blown away, and oxidized by the blast; the waste is very great, and the iron hard and inferior.

This is a very practical plan: the vessels are easily made, at a very small expense, and no part of the process requires more than ordinary care. The work can be done by any one, and the pots when filled are quite equal to the best scrap iron, and as readily handled. Each pot will hold 110 lbs., and cost about 15 cents or three dollars per ton.

The loss is not more than that of other scrap iron, or about 10 per cent.

This process is in successful use at a number of foundries in the neighborhood of Lowell, and at the Industrial Works of this City, and is giving entire satisfaction. In castings made with from one-fourth to one-third shavings, the grain of the iron is improved, it is closer, will finish better, and works well under the tool. A piece of casting was shown which was one-third shavings and two-thirds pig. The grain is very close, almost equal to wrought iron, while the iron is soft and strong.

Mr. Pevey's mode must prove valuable to parties producing large quatities of shavings.

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## COMMITTEE ON SCIENCE AND THE ARTS.

### *Report on Linus Yale, Jr's., Improvement in Locks for Banks, Safes, and Doors.*

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination, "an Improvement in Locks for Banks, Safes, and Doors," invented by Linus Yale, Jr., late of Newport, Herkimer County, New York; now of Philadelphia, Pennsylvania—REPORT:

That they have examined carefully the construction of this important improvement, and find it to be, briefly, of the following described construction and arrangement:

A circular key-hole, with a small slot or notch, permits the introduction of a key with a square pin on the stem, by which the various movements are made in the act of turning it round. No other opening is presented in the lock; when the revolution of the key commences after its insertion, a pod is separated, carrying the bits with which it is furnished, to another part of the interior of the lock, and at the same time covering the hole by which it had been inserted with a steel plate; a continuation of the movement, then presses the tumblers in their carriage, against the bits of the key-pod, and adjusts them to the proper position to receive the fence-tumblers, which, when so adjusted, permit a cross-head to be slid into position with the fence-tumblers, and with it a "bolt dog," which lies behind the bolt-frame, so as to allow their withdrawal by a further movement of the key. The conclusion of the revolution of the key, brings the key-pod to its original place, where it is attached by a dowel and dove-tail, and may be withdrawn in the same condition in which it was inserted.

They key has eight bits capable of change, in relative position, and may further be reversed, so that the permutation principle is carried to an extent that, if calculated, might possess interest to those who are fond of a long array of figures. It is sufficient for our purpose to say, that it is too near infinity to offer any inducement to manipulation by several successive generations of mankind.

It is believed that this general description of the movements of this

lock is all that is needed, for it is perfectly evident that no description, without the aid of diagrams or models, could render its construction and movements intelligible ; let it suffice therefore to say, that a reverse action locks and secures the bolts, and a change in the bits of the key, adjusts the tumblers and fence-tumblers, and locks and unlocks them, when so adjusted, and prevents the use of the key when disarranged.

In the opinion of the Committee, this lock possesses merits of the highest order, and gives as much security as it is possible by human ingenuity to confer upon such means of protection. The reasons which have guided the Committee to this result, are as follows:

A small sized and conveniently portable key. A simple circular key-hole, affording little or no opportunity to insert any means of feeling, measuring, or impressing by sweeping or otherwise. The separation of the pod, with its bits, and its removal to another part of the lock, rendered inaccessible by the sliding of a plate over the aperture by which it had entered. So much for security. The Committee further consider this lock to be of superior construction, from the entire absence of all springs; one only, of the least objectionable kind being contained in the key.

The permutation arrangements give perfect security as far as that principle is concerned.

Finally, the workmanship of the lock, which we have examined, is of a superior order, and is in itself a recommendation of no ordinary merit.

For these reasons the Committee are of opinion that the lock of Mr. Linus Yale, Jr., of Philadelphia, is the most perfect in its principles, and best in execution that has come under their notice ; and that it will be found invulnerable, even to the hands that have succeeded in removing the supposed security of its far-famed predecessors.

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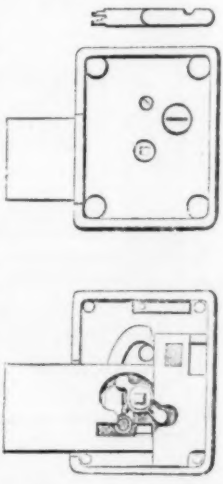
The Committee also examined a small economical lock, presented to their notice by Mr. Yale, and found it to consist of a box, enclosing a carriage, sustaining and carrying a set of five tumblers, which carriage is moved by cams, upon a spindle with an exterior knob. The key-hole is a mere slit, about $\frac{1}{16}$th of an inch in width, giving entrance to a flat key, with the wards upon the end. These being of unequal height depress the tumblers to the proper adjusted position, and allow the turning of the handle or knob to set the carriage in motion, thus carrying away the tumblers, and at the same time closing the key-hole, by sliding over its aperture, it being necessary to remove the key previous to any other movement, the carriage is then put into a position which will allow a further movement of the handle to draw the door bolts.



A reverse action of the knob, returns the carriage and door bolts, and an ingenious inclined plane or guide, re-sets the tumblers to their original place, and the door is thus locked.

This lock, like the preceding, but more expensive and elaborate arrangement, combines principles that appear important: that of removing the tumblers from their original position, and closing the aperture or key-hole, creating in this respect a marked feature of security. It is also free from the inconvenience and liability to derangement of springs, being entirely without them.

It is true, that the permutation principle is not embraced; nevertheless, we are of opinion, that it is an ingenious, economical, and very secure lock; and is worthy of the very highest commendation for its combined qualities.

By order of the Committee,

Philadelphia, June 12, 1856. WM. HAMILTON, *Actuary.*

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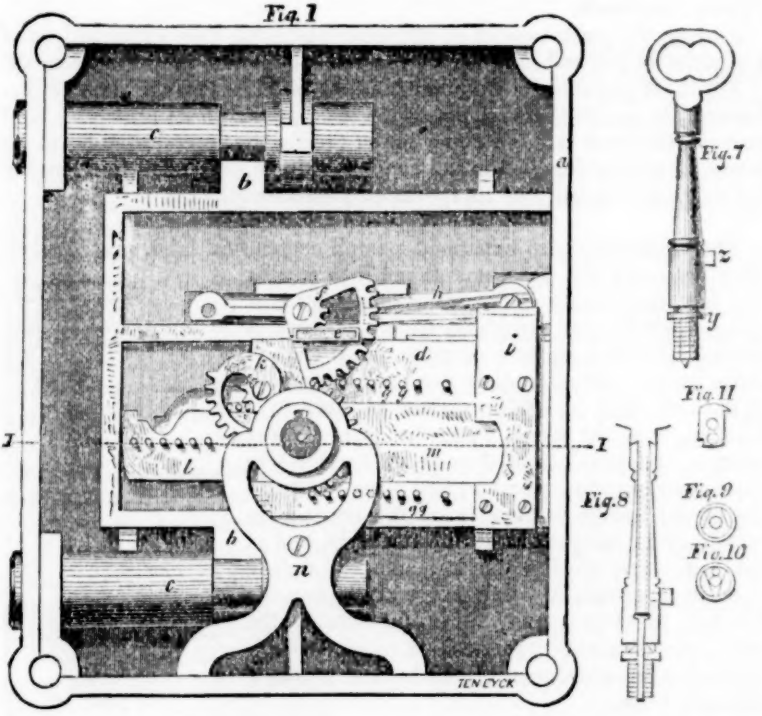
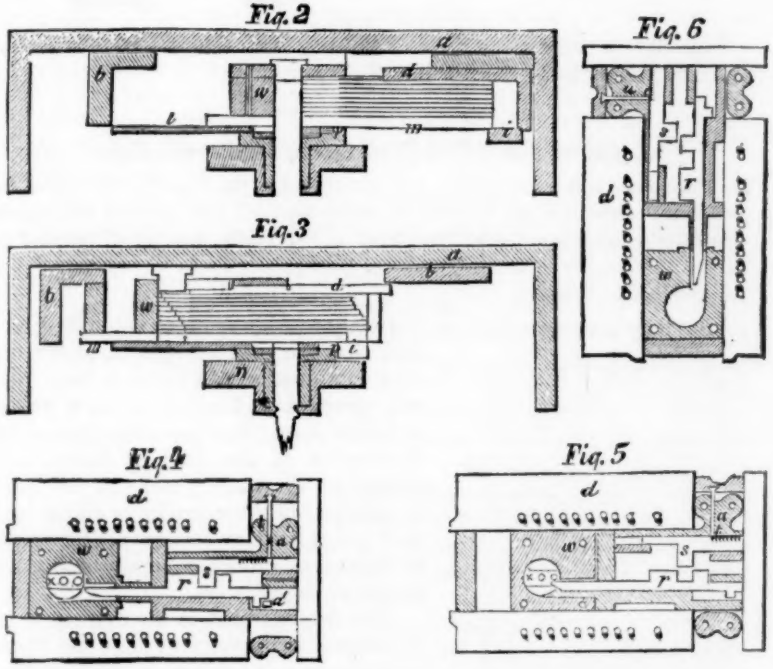
*Description by the Inventor.*

Fig. 1 is a plan of the lock in the unlocked position. Fig. 2 is a section of the same through the line I I, from above, with the key-tumblers




in their normal position. Fig. 3 is the same, showing the key-stem in the key-hole, the inner key-hole closed by the hard plate *m*; the key-bits carried into the lock, and the key-tumblers impressed by them; the

cross-head *i* is also shown in contact with the driving wheel *f*. Figs. 4, 5, and 6 are plans of the tumbler carriage *d*, with the hard plate *m*, and cross-head *i* removed to show the tumblers. In Fig. 4 the key tumblers *r*, and fence-tumblers *s*, are shown in the unlocked or normal position, held immovably in their place by the pin *a'*, which is attached to the hard plate *m*. The key-bits *x*, are shown as just inserted, ready to be impressed against the tumblers. Fig. 5 the key-bit in place, with the key-tumbler *r*, pressed into it, the fence-tumbler *s*, as arranged by the key-tumbler now moved away from it, and held immovably by the knife-edge *t*, which has now entered that one of its notches which corresponds




with the length of the key-bit used. This plan shows the arrangement of the tumblers when the inner key-hole is closed, corresponding to Fig. 3. In Fig. 6 the true-tumbler *s*, fastened by the knife-edge, in the position given it by the key-tumbler *r*, in locking; the latter as carried to its normal position, where it must always remain immovable when the external key-hole is open: the key is now withdrawn.

Fig. 7 is the key; *z*, the square pin or handle, which turns the driving wheel; *y*, the key pod attached to the handle by a dove-tail and spring dowel. Fig. 8 is a section of a key, showing spiral spring in handle, and spring dowel to keep the pod from slipping off. Figs. 9 and 10 show the dove-tailing of the end of the handle, and the key were they unite.

Fig. 11 is a key-bit with centre hole to pass over the centre pin, also hole for the screw to hold it with the others on the key-pod.

Fig. 12.

Fig. 12 is a perspective view of the key with the pod of bits shown detached, ready to be carried into the lock.

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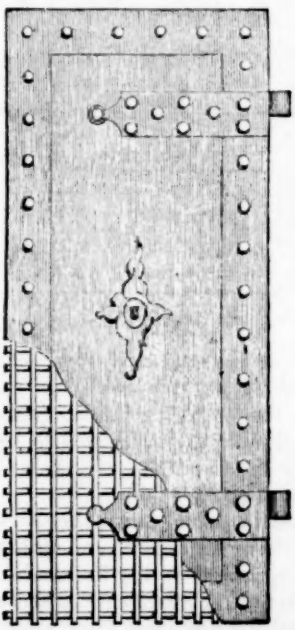
### *Report on Yale's Iron Bank Doors, Vaults, and Safes.*

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination, "the Chilled Iron Bank Doors, Vaults, and Safes," invented by Linus Yale, Jr., late of Newport, Herkimer County, New York.; now of Philadelphia, Pennsylvania—REPORT:

That they have examined the drawings and illustrations submitted, and find that the plan or system, arises out of a combination of chilled or hard iron, and wrought or tough iron, in a woven or basket form; thus guarding against the destruction of the first by blows of a sledge, or the cutting away of the latter by quieter but more insidious efforts, and thus giving increased security to the places of deposit of valuables, against the usual means of depredation.



The arrangement is so evidently an important improvement, that the Committee have no hesitation in giving the invention a high estimate of consideration, and a recommendation of it to those who need protection, which it will undoubtedly give against violence, or the quieter but more dangerous use of cutting instruments; and thus by the combination of hard and tough materials, presenting difficulties to depredation almost, if not quite, insuperable.

By order of the Committee,

Philadelphia, June 12th, 1856. WM. HAMILTON, *Actuary.*

## BIBLIOGRAPHICAL NOTICE.

*Report of Explorations and Surveys to ascertain the most Practical and Economical Route for a Railroad from the Mississippi River to the Pacific Ocean, made under the direction of the Secretary of War, in* 1853-4. Vol. I, 4to; pp. 651.

The plan of a railway from the Atlantic to the Pacific Ocean across the Continent, moves like a magnificent vision before the American mind. It seems a necessity to chain together by it the two parts of the Empire, which now, are divided by an immense expanse of country. This scheme has awakened the public interest, and undergoes now, after a general discussion, a closer investigation. Before us lie the reports of explorations and surveys made by order of Congress, to ascertain the most practicable and economical route for a railroad from the Mississippi River to the Pacific Ocean. There were five different routes investigated with the following results:

1. Route near the forty-seventh and forty-ninth parallels.

The advantages of this route are—its low profile, which is important in relation to climate; its easy grades and small amount of ascents and descents; the great extension west of the prairie lands for the supply of timber over the western half of the route; the facilities which the Columbia River and Missouri will afford to the construction of the road; in the short distance from the Mississippi to a sea-port of the Pacific, (1864 miles to Vancouver); in the western terminus of the road on Puget Sound, being nearer to the ports of Asia, than the termini of the other routes; in the proximity of the eastern terminus to Lake Superior, and in the existence of coal on Puget Sound.

Its disadvantages are—the difficult and costly construction, including a long tunnel through a mountain region of 550 miles; the high freshets of the rivers which are to be passed; the severe and long winters; the distance of its western terminus from San Francisco; the proximity of the whole route to the English possessions.

2. Route near the forty-first and forty-second parallels.

Its advantages are—comparatively cheap construction owing to the low run of ascents and descents; the probability of large coal fields in the middle of the route; the proximity of Utah.

Its disadvantages are—the very difficult and costly constructions along the Sacramento River, through the cañon of the Timparogos, through the Black Hills to the South Pass; in the great elevation of the summits in the Rocky Mountains, and of its plain; the long and severe winters, and the snows on it.

3. Route near the thirty-eighth and thirty-ninth parallels.

No peculiar advantage was developed in the exploration of this route, except the probability of the existence of extensive coal fields in the valleys of the Grand and Green Rivers.

The extraordinary difficulties to be overcome from the Coo-che-to-pa Pass to the Great Basin, (500 miles,) render the route impracticable.

4. Route near the thirty-fifth parallel.